

SentinelRAID Series

Fibre-to-SCSI/SCSI-to-SCSI RAID Controller



Hardware Manual

Revision: 1.4

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For Europe



This device is in conformity with the EMC directive.

FCC Class B Radio Frequency Interference Statement

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

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

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

Warning:

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.

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 you

authority to operate the equipment.

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About This Manual

This manual provides the necessary information a system integrator with the knowledge and experience in SCSI, Fibre, and RAID technologies needs to install and/or upgrade the SentinelRAID series controllers. The SentinelRAID series includes: SentinelRAID 100, SentinelRAID 150, SentinelRAID 1000, SentinelRAID 1500, SentinelRAID 2000, and SentinelRAID 2500. The dual redundant chassis include SentinelRAID 2000R1/2500R1, 2000R2/2500R2, and 2000R3/2500R3. For information on the configuration and firmware settings of your controller, please refer to the *Generic Operation Manual*. Because of the differences in architecture, the SentinelRAID 100 and 150 will be discussed in different manuals.

Models included in the discussions of this manual:

Models	Channels
SentinelRAID 1000	2 Ultra2 on base channels (2 Ultra2 & 2 Fibre; 2 Ultra2 & 2 Fibre + 2Ultra2; 2 Ultra2 & 4 Ultra2; 2 Ultra2 & 2 Fibre)
SentinelRAID 1500	2 Ultra160 on base channels (2 Ultra160 & 2 Fibre; 2 Ultra160 & 2 Fibre + 2Ultra160; 2 Ultra160 & 4 Ultra160; 2 Ultra160 & 2 Fibre)
SentinelRAID 2000	4 Ultra2 (4 Ultra2 & 2 Fibre; 4 Ultra2 & 2 Fibre + 2Ultra2; 4 Ultra2 & 4 Ultra2; 4 Ultra2 & 2 Fibre)
SentinelRAID 2500	4 Ultra160 (4 Ultra160 & 2 Fibre; 4 Ultra160 & 2 Fibre + 2 Ultra160; 4 Ultra160 & 4 Ultra160; 4 Ultra160 & 2 Fibre)
SentinelRAID 2000R1	Redundant 3 Ultra2
SentinelRAID 2500R1	Redundant 3 Ultra160
SentinelRAID 2000R2	Redundant 4 Ultra2
SentinelRAID 2500R2	Redundant 4 Ultra160
SentinelRAID 2000R3	Redundant 2 Fibre (1 GHz) and 2 Ultra2
SentinelRAID 2500R3	Redundant 2 Fibre (1 GHz) and 2 Ultra160

The manual will be continuously updated to be compatible with the newest releases of product revisions. This manual (v. 1.4) is fit for the operation with SentinelRAID series of the following hardware and firmware versions:

SentinelRAID 1000	PCB version: 1.0 or above
SentinelRAID 1000	PCBA version: 1A or above
SentinelRAID 1500	PCB version: 2.6 or above
SentinelRAID 1500	PCBA version: 5A or above
SentinelRAID 2000	PCB version: 2.0 or above
SentinelRAID 2000	PCBA version: 2A or above
SentinelRAID 2500	PCB version: 2.6 or above
SentinelRAID 2500	PCBA version: 8A or above
SentinelRAID 2000R1/R2	PCB version: 2.21 or above
SentinelRAID 2000R1/R2	PCBA version: 13A or above
SentinelRAID 2000R3	PCB version: 2.21 or above
SentinelRAID 2000R3	PCBA version: 3A or above
SentinelRAID 2500R1/R2	PCB version: 2.6 or above
SentinelRAID 2500R1/R2	PCBA version: 8A or above
SentinelRAID 2500R3	PCB version: 2.6 or above
SentinelRAID 2500R3	PCBA version: 5A or above
Firmware Version:	3.14, 3.21, or above
Part no. for this manual:	M3200UMH14

The proceeding discussions of the SentinelRAID series will use "the controller" to indicate all the variants of the controller series. Unless specified, different configurations of daughterboard/backplane will not affect the operations and adjustments of controller firmware and hardware components.

Except for the number of base channels and the different interfaces they use, variants of the controller series are compliant to the use of the same daughterboards for channel expansion. They use the same battery backup modules, cables, power cables, converters, and other accessories.

Revision History

- 2/20/00 version 1.1 initial release
- 6/16/00 version 1.2 photo copy
 - Added SCSI/Fibre cable specifications
 - Added connector and jumper identification and pinouts information
 - Added system information and hardware parameters configuration
 - Added details of termination jumpers
 - Added details of the IFT-9515, IFT-9519, and IFT-9535 cables
 - Added Chapter 5 hardware configuration with the dual redundant controllers
- 6/20/00 Version 1.3 official printing
- 5/01/01 Version 1.4
 - Added out-of-band connection method
 - Added details for SentinelRAID 2500 new PCB version
 - Added Ethernet cable IFT-9537
 - Added redundant controller basic understanding
 - Added configuration topologies
 - Removed instructions on TextRAID manager

Standard Package Content

- The RAID controller
- Generic Operation Manual
- This hardware manual
- IFT-9512 serial port combo cable
- IFT-9531 bezel key
- IFT-9011 null modem
- An external LVD terminator for SentinelRAID 2000R1
- IFT-9537 LAN cable (available with newer release of PCB version)

NOTE:

- *The controller series allows flexible combinations of I/O channels by adding daughterboards. However, it should be noted that the controller daughterboard, daughterboard backplane, and battery modules are optional and will be shipped in independent packages. The installation of these items should be completed by storage system integrators.*
 - *The IFT-9515 terminator power cable is included with a daughterboard backplane.*
 - *The IFT-9535 cable is necessary for redundant controller configuration and is available with a conditional order.*
-
-

Chapter 1 Overview

Introduction

Thank you for purchasing the controller. The SentinelRAID series covers the whole range of demands for RAID storage in high availability, high performance, and fault management for today's complex network environment. The controller is a SCSI-to-SCSI RAID controller designed to provide RAID 0, 1 (0+1), 3, 5, 10, 30, 50, or JBOD RAID storage to any host system equipped with an Ultra 2 or Ultra160 interface. Connectivity via Fibre channel is supported with an expansion daughterboard. The controller is completely independent of the host operating system. All RAID functions are performed by an IBM PowerPC® RISC CPU with high-speed SDRAM's and firmware in flash memory. In effect, it endows the host system with high-speed and fault-tolerant disk storage operation using RAID technology. It is an ideal solution for weaving multiple hard disks into one or more contiguous volumes as well as enhancing availability, integrity, and performance to storage.

Important Features:

Fault Tolerance:

The controller has comprehensive drive failure management that allows automatic reassignment of reserved blocks when a bad sector is encountered during a write. Automatic drive failure management is enhanced by dedicated or global spare drive. Controller automatically disconnects with a failed drive and rebuilds data onto a spare drive, which in turn replaces the defective drive after the rebuilding process. A failed drive can also be replaced manually, followed by background rebuilding of data. Hot swapping is supported through automatic

disconnection from a failed drive and detection of a reserved drive. All these failure recovery procedures are transparent to the host system.

Two controllers can operate in the dual-active mode. The dual-active configuration can sustain single controller failure without interrupting I/O access. Should one controller fail, I/O requests from host can be shifted to the surviving controller almost instantly. This feature boasts the protection of cached data. Cached writes are constantly synchronized between controllers and thus allowing the surviving controller to continue the unfinished writes afterwards. During normal operation, both controllers are actively processing data, thus improving the overall data throughput and I/O processing performance.

Flexible Configuration:

All channels are Ultra160 or Ultra2 and can be configured as host or drive. Eight logical drives can be created from physical drives and eight logical volumes can be created from one or several logical drives. Users may further divide storage capacity by partitioning each of the logical units into 8 portions. Variable RAID levels can be applied to different logical units with the support of dedicated spare drives. Two or more ID/LUN's can be mapped to the same logical drive for redundant host operation. Host LUN mapping allows a variable combination of each host channel ID with up to 32 LUNs.

S.M.A.R.T. Support:

The controller dynamically supports S.M.A.R.T. with enhanced features. When S.M.A.R.T.-related errors are reported by an unstable drive, controller will respond with pre-configured methods to preserve the integrity of data. System administrators may also copy the data in a drive suspected of defects to a spare drive and then replace it online.

Expansion:

The controller supports up to 8 SCSI or 6 SCSI and 2 Fibre channels by adding an expansion daughterboard.

User-friendly Configuration Utilities:

There are multiple choices with the interfaces or management programs for configuring a RAID system. Administrators may choose one or more from the LCD front panel, firmware-embedded configuration utility, and the Java-based GUI RAID manager, for local or remote management.

SAN Support:

RAID-based mapping (LUN Filtering: autodetect WWN list of Fibre channel devices).

Controller Architecture:

The controller is developed from Infortrend's PowerPC-500129 ASIC architecture, a third generation 64-bit controller architecture that efficiently eliminates interface internal bottlenecks. The controller's high performance derives from a PowerPC® 750 RISC microprocessor which provides a 64-bit 66MHz path to SDRAM. The 500129 integrates SDRAM control, CPU peripheral, dual 64-bit PCI buses, and hardware assisted XOR functions. The operating frequency of the 500129 ASIC is 66MHz for CPU and DRAM interfaces, 33MHz for PCI interfaces. Two 64-bit 33MHz PCI buses can operate independently to maximize performance.

Functional Features:

Six operating modes for logical drives:

JBOD	Just a Bunch of Drives
Non-RAID	Disk Spanning
RAID-0	Disk Striping
RAID-1	Disk Mirroring and Striping (RAID 0+1)
RAID-3	Disk Striping with Dedicated Parity
RAID-5	Multiple Block Striping with Interspersed Parity

Other RAID levels:

RAID 10: a Logical volume with RAID 1 logical drives

RAID 30: a Logical volume with RAID 3 logical drives

RAID 50: a Logical volume with RAID 5 logical drives

→ Comprehensive failure management including:

- Automatic bad block reassignment
- Drive hot swapping
- Controller hot swapping (in redundant controller configuration)
- Spare drive operation [supports both Global Spare and Local (Dedicated) Spare]
- Background rebuilding (Rebuild priority selectable)
- Verify-after-Write supported on normal writes, rebuild writes and/or RAID initialization writes
- Regenerate parity of logical drives in background
- Supports S.M.A.R.T. drive functionality with enhanced features
- Works with any operating system without additional software drivers

→ 5.25" drive profile allows easy integration into external subsystem enclosures or directly into the host system's drive bay

→ Up to seven drive channels (with optional 4-channel upgrade) for a total of 105 connected drives (SCSI operation)

→ Supports up to 15 SCSI ID's per channel or 125 ID's per Fibre loop

→ Three optional upgrade daughterboards:

IFT-9284U2/ 4 Ultra2/Ultra160 SCSI channels

IFT-9284U3

IFT-9284U2F/ 2 Ultra2/Ultra160 SCSI and 2 single-

IFT-9284U3F loop Fibre channels

IFT-9282F 2 1G Fibre channels

Elongated versions of daughterboards are available for OEMs who design custom backplanes

→ Up to 8 logical drives, each with independent RAID modes; up to 32 LUN's per SCSI ID (multiple SCSI ID's per channel are supported)

→ Up to 8 partitions per logical drive/logical volume

→ Logical drive and logical volume can be assigned a name for ease of identification

- Number of drives for each logical drive: 31 (RAID 3 or 5); 45 (RAID 0 or NRAID); 44 (RAID 1)
- Dynamic mapping of LUN's to logical drives. Two or more LUN's can be mapped to the same logical drive for redundant host operation
- Concurrent/background logical drive initialization
- Performance optimization for either sequential or random I/O
- Allows multiple drive failure and concurrent multiple drive rebuild of a RAID (0+1) logical drive
- Configuration of individual SCSI target parameters
- Controller and logical drive/logical volume can be assigned a name for ease of identification
- Prior to first disk access, it allows adjustment of delay time during controller initialization to enhance compatibility with slow-initial drives
- All channels are Ultra2 or Ultra160 SCSI (backward compatible to SCSI-1) and can be configured as either a host or drive interface
- Two or more SCSI channels can be simultaneously set as host interface for redundant host system operation
- Compatible and will automatically match any SCSI hard disks with SCSI-1, SCSI-2, or (Ultra)-Wide-SCSI (1 or 2) specification
- Full SCSI implementation including Tagged Command Queuing and Multi-Threaded I/O
- Uses PowerPC[®] RISC CPU with all executable firmware downloaded into high-speed SDRAM
- SDRAM DIMM supports ECC function
- Architecturally supports up to 1GB of intelligent Read-ahead/Write-back cache
- Firmware resides in easy-to-update flash memory
- Write-through, write-back, Multi-threaded intelligent predictive read-ahead, optimized sorted grouped writes
- Front panel LCD and push buttons for configuration and message display
- Supports TELNET with PPP protocol for remote administration

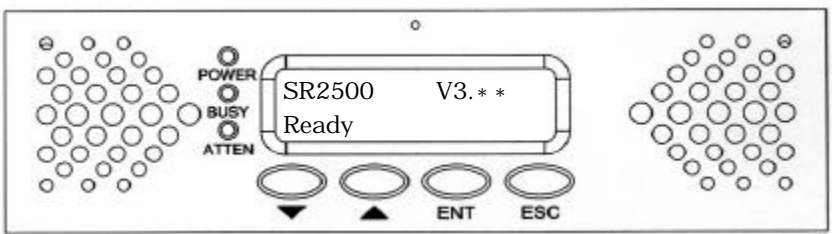
- Cross-platform Java-based RAIDWatch manager and RS-232C terminal interface for RAID management
- SAF-TE support
- ISEMS via I²C interface for enclosure management (ISEMS: Infortrend Simple Enclosure Management Service)
- In-band Text RAID Manager provided for configuration through SCSI/Fibre rather than RS-232C
- TCP/IP agents provided for remote administration via RAIDWatch Manager or SNMP trap event monitoring with third-party SNMP software
- Active-to-active Redundant Controller Configuration via SCSI synchronized cache connection
- Cableless Redundant Controller solution which integrates two controller in a full-height chassis with system backplane. All channels, including the synchronized cache channels, communicate between controllers via a controller backplane.
- Host-side redundant loops supported (Host computer software/drivers required)
- Drive-side redundant loops supported with intelligent load balancing
- Controller self-monitoring features: monitors the voltages (+5 and +12), temperature (CPU, ASIC, board) and fan rpm status (front panel fans)
- Dual power connectors design: to avoid single point of failure on the power connector, also guarantees efficient power source
- Uses 168-pin PC-100 industrial standard SDRAM module. Buffered, unbuffered, ECC, non-ECC, registered, non-registered modules are supported
- Separate-bus architecture increases Sequential I/O performance
- Features of the dual redundant controllers will be discussed in Chapter 5.

The controller has been designed with ease of integration and maintenance in mind. The controller already includes all the major operational requirements of a RAID subsystem. The overall features of a complete RAID subsystem will, however, depend on the actual components used and the creativity of the integrator.

Chapter 2 Hardware

Introduction

2.1 Locations of the Parts



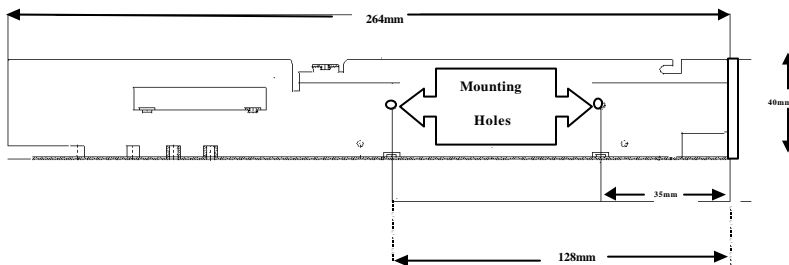
LCD Panel:

POWER	Lighted LED indicates power is on.
BUSY	Unlit indicates no activity. Blinking indicates data is being accessed.
ATTEN	Lighted LED indicates unprocessed data is still cached in the memory.
▼ ▲ Buttons	Scroll through available options.
ENT button	Choose or executes an option.
ESC button	Return to previous menu or cancel selection.
2 x 16 LCD	Displays throughput during normal operation, approximately 128Kbytes/sec per division. Displays message for configuration and management.

OEMs may prefer board-only's and the fan detect signals (connected to front panel) should be disabled by jumper switch. Please refer to Appendix D for details.

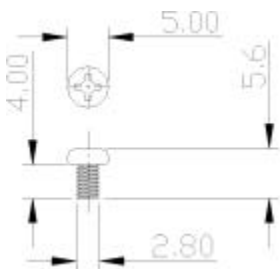
Mounting Holes:

The controller can be installed into any industrial standard 5.25" half-height canister. To secure the controller within an enclosure chassis, drive screws through the enclosure's mounting rails and into the four mounting holes on the sides of the controller. Screws used for mounting the controller should not extend 5.6 ± 0.3 mm. The keep out area is 3 mm along the long sides of controller board. The part of screws driven into the controller chassis should not extend this limit into the controller board. Longer screws may cause damage. Use M3 cross flathead screws for securing top cover. Use the same screws for all the mounting positions on controller chassis or PCB boards.



Controller Side View

Use M3 (2.8mm thread) metric screws, 4mm long.



Component List:

Controller Components:

1. Single Controller: Controller main circuit board housed in a 5.25" half-height canister with a removable front panel and controller backplane. Board-only solution is provided for OEMs who design custom backplanes. Daughterboard adds additional I/O channels and the installation of daughterboard and daughterboard backplane should be accomplished by system integrators.
2. Dual Redundant Chassis: Two controller boards in a 5.25" full-height chassis with a removable front panel and system backplane.

Items Included in the Accessory Kit but not Installed:

1. Serial cable - IFT-9512 (redundant controller configuration requires IFT-9535)
2. Terminator power cable - IFT-9515 (provided and should be installed with a SCSI backplane)
3. Null modem
4. Ethernet cable - IFT-9537 (plug to receptacle; PCB version 2.7 and above)
5. Bezel key

Not Included but Necessary:

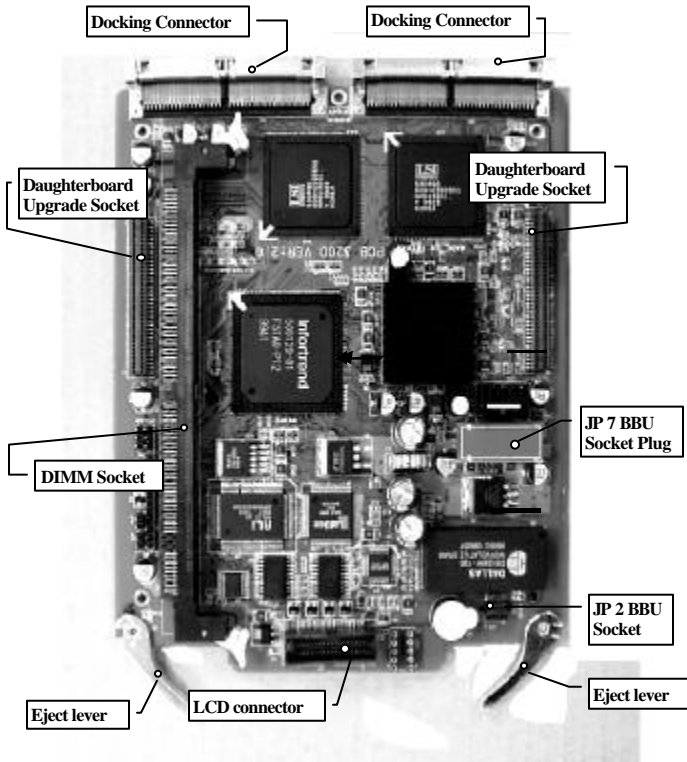
1. Cache memory (model names sub-fixed with "D" are shipped with DIMM modules)
2. Fibre/SCSI cables and SCSI terminators
3. Power cords
4. I²C signal compatible cables for enclosure device monitoring

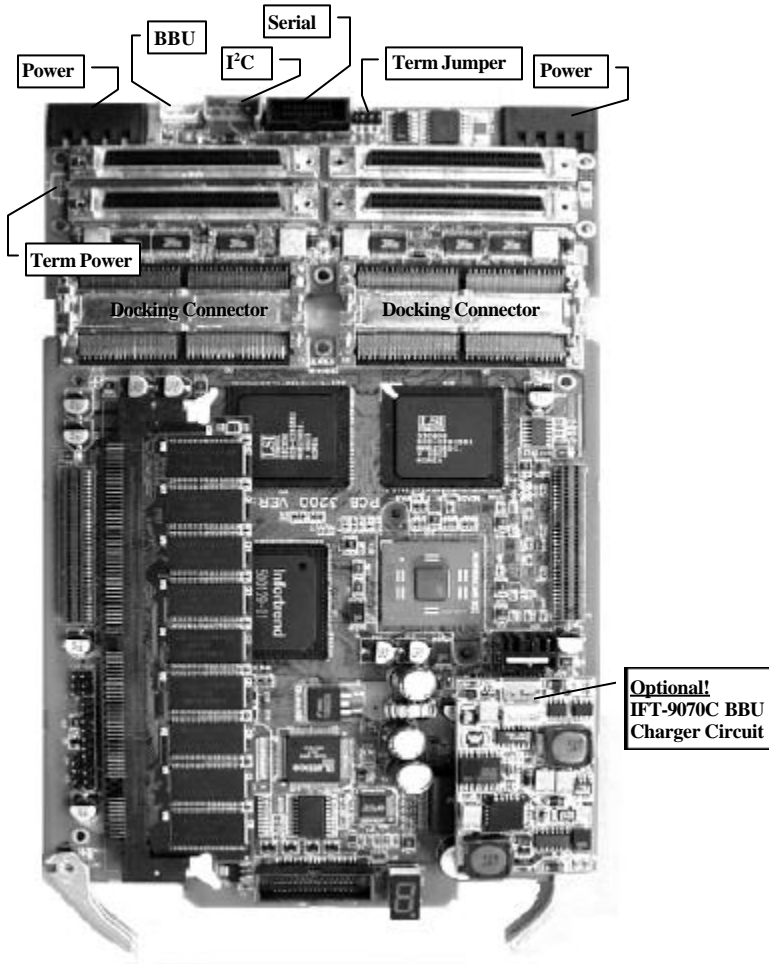
Optional

Battery modules

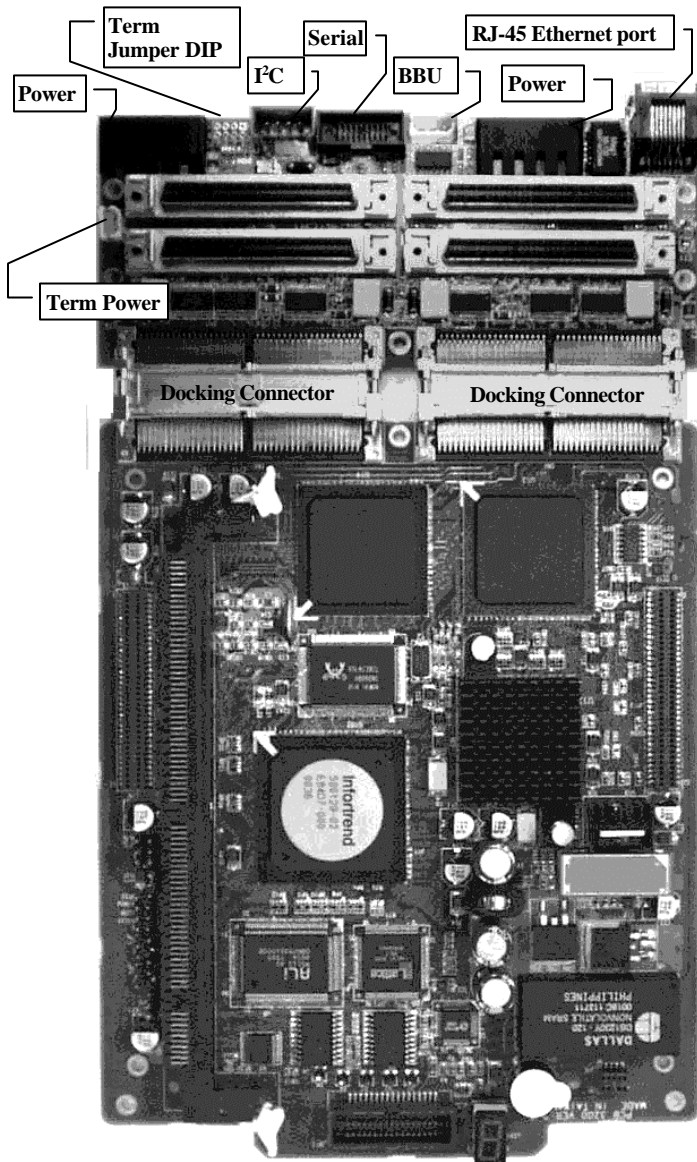
The Controller Main Board:

SentinelRAID 2000



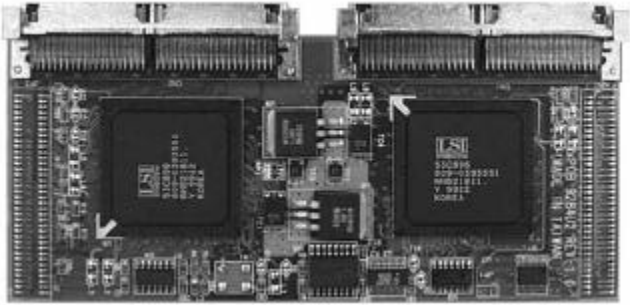


SentinelRAID 2500

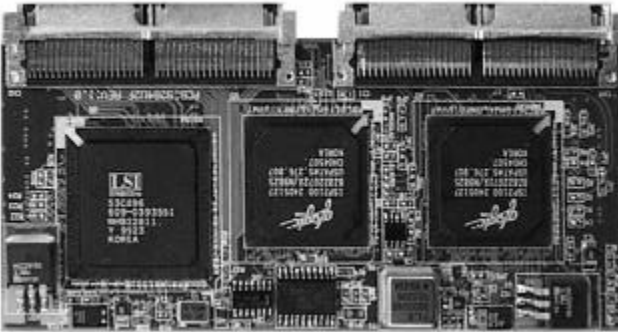


Main board PCB v. 2.7 and v. 1.3 backplane

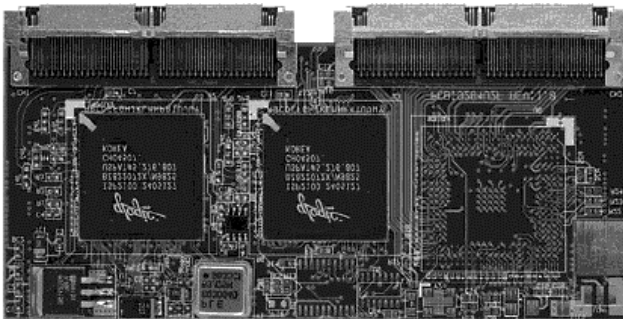
The Daughterboards:



IFT-9284U2 / 9284U3

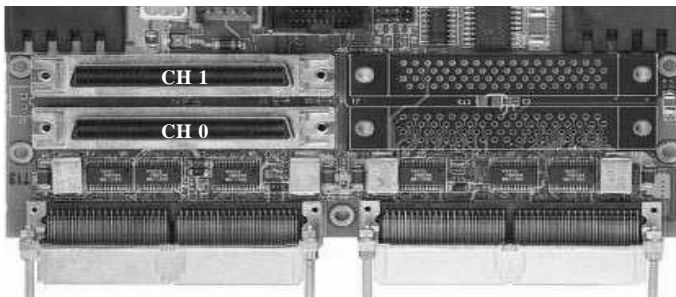


IFT-9284U2F / 9284U3F

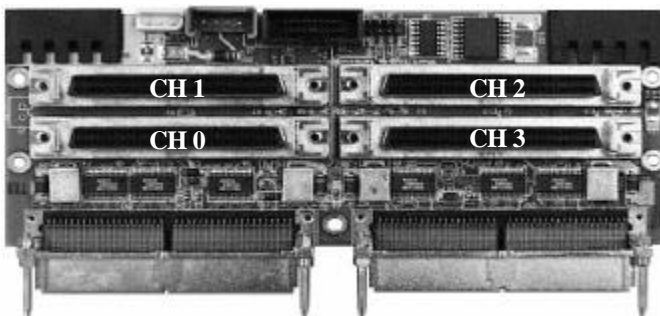


IFT-9282F / 9282F2

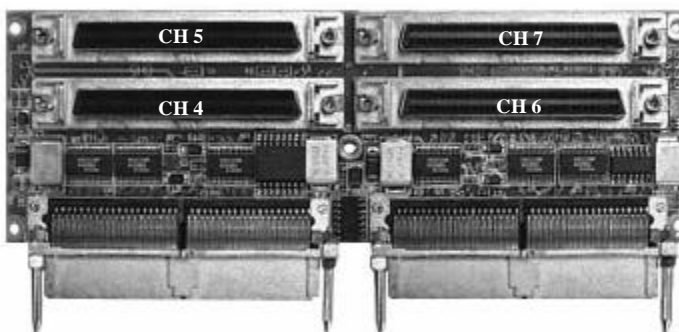
Backplane Boards:



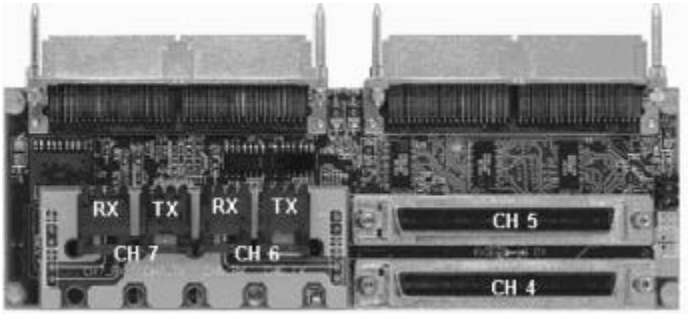
IFT-9288MB2,
(Backplane to the SentinelRAID 1000 main board)



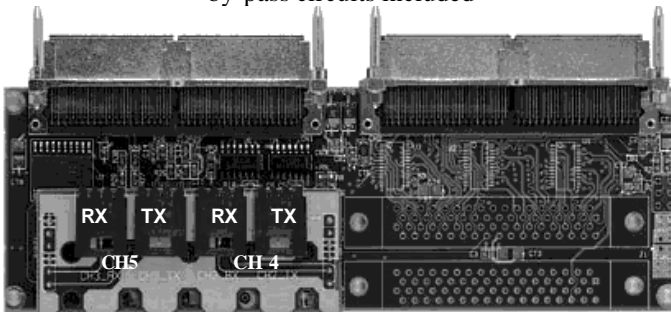
IFT-9288MB4
(Backplane to the SentinelRAID 2000/2500 main board)



IFT-9288B4
(Backplane to the IFT-9284U2/U3 daughterboard)



IFT-9288B4U2F
(Backplane to the IFT-9284U2F/U3F daughterboard)
-by-pass circuits included-



IFT-9288B2F
(Backplane to the IFT-9282F daughterboard)
-by-pass circuits included-

Pictures to be added: IFT-9288B4U3F2 and IFT-9288B2F2

2.2 Accessories:

Battery Module: optional

Optional battery daughterboard

IFT-9070C (charger circuit board)



IFT-9010C (battery cell pack)



IFT-9519 (Extension Cable for connecting and cascading battery cell packs)



Cables: included in kit

IFT-9512 (combo-cable for serial ports COM 1 and COM 2)



IFT-9011 (Null Modem)



IFT-9537 (Ethernet Cable)



Cable not included in kit



IFT-9535 (serial port combo-cable for redundant controller configuration)

Included with daughterboard backplane

IFT-9515 (terminator power cable)



Bezel key: included in kit

IFT-9531 (bezel key)



Chapter 3 Getting Started

3.1 Considerations

Ventilation

The controller uses a convection-cooled processor; however, airflow across the heat-generating chips is required for operation within the normal temperature range. Failure to provide an enclosure capable of sufficient airflow across controller board will void our warranty. Controller and drives should be operating at an ambient temperature below 50°C. The voltage safety tolerance is listed in Appendix A (A.6).

Static-Free Installation

Static electricity can damage electronic components. Most of the controllers returned for repair are the results of improper installation and ESD damage. Before proceeding with controller unpacking, discharge your body's static electric charge by touching a grounded metal surface and put on a grounded anti-static wrist strap.

- Do not remove controller from the anti-static bag until you are ready to install. Do not lay PCB board on top of the anti-static bag. Only the inside of the bag is anti-static.
- Handle PCB boards by holding their edges and avoid touching the chips and connector pins.
- Avoid carpet, plastic, vinyl, and styrofoam in your work area.
- Make sure all components are room temperature before working with them.

Jumpers and Connectors

Installing Infortrend's line of controllers usually does not require configuring jumpers. If there is any need to disable or change controller features through jumper switches, please refer to Appendix D of this manual.

Notice for Unpacking:

Provide a static free environment to unpack the controller components. The controller board is packed inside an anti-static bag and foaming. Remove the controller carefully and inspect if it is damaged. If the controller appears damaged or any of the items in the packing list is missing, please contact Infortrend for assistance.

Interfaces

Ultra160 is basically a continuous superset of Ultra2. Except for the doubling data rate, Ultra160 models of the SentinelRAID series share all of the features with earlier Ultra2 products. Ultra160 products will operate using the same backplanes, connectors, cables, and other accessories. Mixing Ultra2 and Ultra160 devices will not cause a bus failure. Ultra160 devices will operate at up to 160MB/second and Ultra2 will operate at up to 80MB/second.

3.2 Assumptions

A RAID system typically consists of a RAID controller, disk drives, and the enclosures or system cabinetries that provide power supply, ventilation, and environmental monitoring service to these components.

RAID controller is the accelerator of I/O functions in a storage system. These functions include the capabilities to provide storage I/O bus performance, to assemble large amount of disk drives into a contiguous whole, to report system events, and many more. The controller, as well as all the hard drives, should be mounted in a cabinetry and provided with adequate power and ventilation.

In spite of the use of different enclosures and cabinetries, the requirements for installing a RAID controller should include the following:

1. A RAID enclosure providing power, proper ventilation, and at least one 5.25" half-height canister for the controller
2. Disk drives installed in drive enclosure(s); controller and drives may be accommodated in the same enclosure
3. Environmental monitoring capabilities on the enclosure(s) through the supported SAF-TE (SCSI), S.E.S. (Fibre), or I²C interface.
4. External terminators and SCSI cables that are adequate for Ultra160 or Ultra2 SCSI channels
5. Environmental Requirements:

Electrical (base module; please refer to Appendix A for more details)

Input	+5VDC \pm 5% (max. 5.4A; normal 4.0A) +12VDC \pm 10% (max. 400mA)
-------	--

Environmental

Temperature	5 to 44 °C
Humidity	10-95%, non-condensing
Altitude	Sea level to 10,000 ft

Installation of a controller means the completion of the following:

1. Integration of RAID controller into the cabinetry
2. Cabling between controller and drive bays / drive enclosure(s)
3. Cabling between controller unit and host computer / Fibre channels through the use of Fibre hub or switch
4. Cabling of other interfaces
5. Installing software utilities, configuring physical drives into RAID, and enabling enclosure devices monitoring

WARNING!

Constant airflow over the surface of the major chips is essential for operation within an acceptable temperature range. The RAID enclosure where the controller is installed must provide sufficient airflow to maintain an internal ambient temperature below 50°C. Failure to utilize a design which keeps the ambient temperature inside the controller below 50°C may void the controller's warranty.

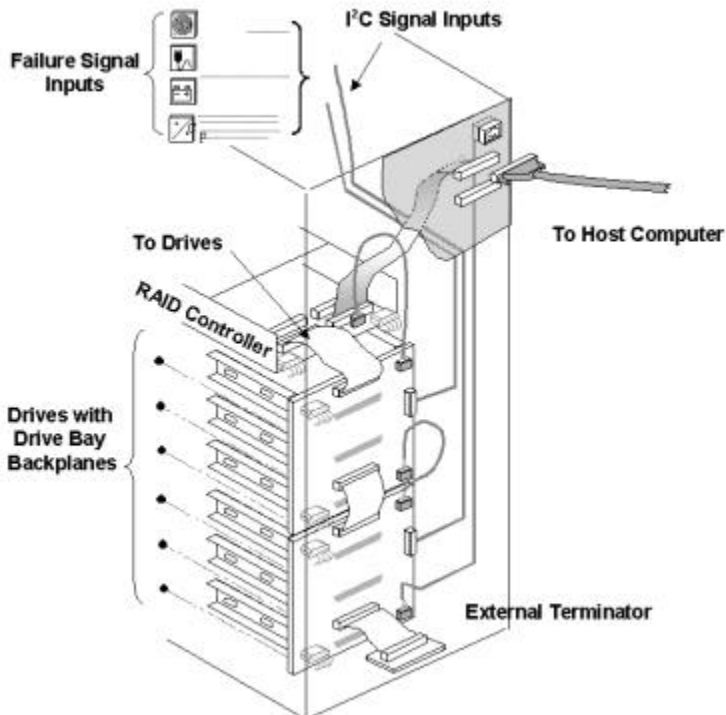
3.3 Steps Necessary for Installing the Controller

Steps for the Hardware Installation:

1. Remove the controller carefully from its package; or, if you are upgrading controller components, turn off all power to the server and RAID enclosure. If you are installing memory to a new controller, jump to step 3. A minimum of 32MB is required.
2. After you turn off the controller power and unplug the power cords, remove the controller from the enclosure cabinet or chassis where it is located. Do not connect or disconnect cables when system power is on.
3. Locate and unscrew the four fasteners on the sides of controller. Remove the controller top cover.
4. When controller front panel and top cover are removed, you may continue with installing hardware components.
5. Follow the instructions, Notes, and Warnings in this manual.
6. Install memory to controller.
7. Check if all the SCSI bus components (cable type, cable length, terminators, and ID setting) you use meet the SCSI conventions.

8. Preparing drives: Please refer to the installation instructions provided by drive manufacturers for information on jumper configuration.
 - Remove terminator or disable terminator on all drives.
 - Enable terminator power from all drives to SCSI bus
 - Set unique ID for each drive.
 - Drive enclosures may have ID setting pre-configured through DIP switches on its drive backplanes.
9. Install the controller in the server/enclosure and attach the SCSI/Fibre/serial cables and terminators as needed. If using on-board terminators for SCSI termination, please refer to the following chapter to shunt the terminator jumpers properly.
10. Make sure all cables are correctly attached in accordance with SCSI rules. Make sure the controller is properly installed. Connect the supported interface for environmental monitoring devices. Turn power on after all components are correctly installed.
11. Install the controller software utilities such as RAIDWatch manager. Software on the host computer can communicate with the controller either through RS-232 serial port, Ethernet port, or the existing I/O interfaces (SCSI/Fibre cable).
12. Configure and initialize your RAID.

Connecting Drive Channels and Host Channel(s)



Above is an example of connecting RAID controller to drives and the host computer. Since all channels can be configured as host or drive, a variety of host/drive configurations are available. The on-board terminator has been enabled on the controller side of I/O channels. On the other end of the SCSI cable, an external terminator is applied. Termination on all the SCSI drives should be disabled. Integrators may choose different interface for the enclosure device management. Connect remote devices (fan rotation speed detector, power supply status sensors, temperature sensors, etc.) on SCSI bus (SAF-TE) or via the I²C interface as displayed in the example. Controller firmware has embedded utilities to help configuring these devices.

NOTE:

It is recommended to enable the terminator circuits on host/drive channels by DIP switches and to install an external terminator on the other end of your SCSI cable. If a drive fails, data traffic will remain unaffected. Also pay attention to the following:

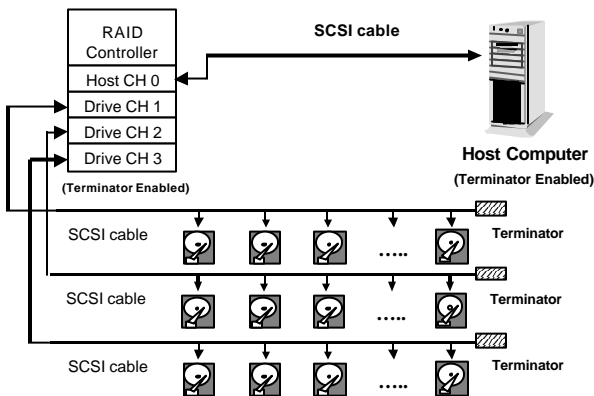
- 1. Refer to the installation documents that came with your drives for information on jumper configuration.*
 - 2. Disable SCSI termination on all drives.*
 - 3. Enable termination power from the drives to the SCSI bus.*
 - 4. Set a unique SCSI ID address on each drive. ID7 should be avoided, which is a default reservation for the controller.*
-

3. 4 Sample Topologies

Supported Configurations:

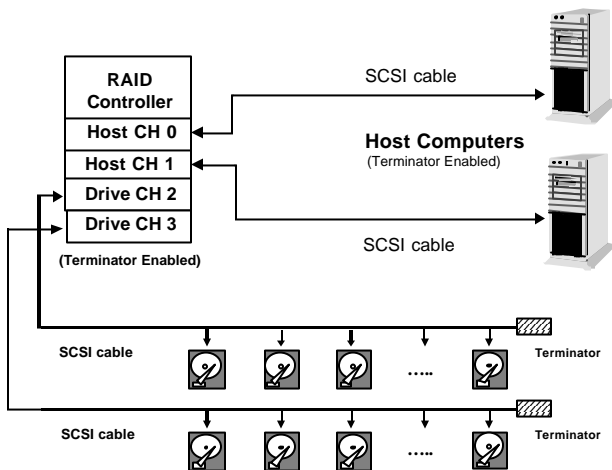
Single-Host Configuration

An example of the operational setup is shown below:



- The SCSI cable must be shorter than 12 meters using high-quality SCSI cable and terminators.
- Channel 0 is the default for host connection.
- Drives are connected through drive channels 1 to 3 (with the expansion daughterboard, there can be up to 7 drive channels).
- SCSI devices on the same channel have their own unique ID number.
- Both the host and drive SCSI cables are properly terminated.
- The terminator of all the hard drives must be disabled.
- The power supply is attached.
- All operation parameters are properly set.

Dual-Host Configuration



The multiple-host configuration is applied when the array is shared by two or more systems. Using each host channel for a host adapter on different host computers can physically isolate one system from another. This configuration is applied when two systems can not share the same SCSI bus as the access route to storage. Unless some file system "Locks" is available, physical drives should be assembled into different logical drives or logical volumes, and each logical unit should be mapped to IDs/LUNs on different host channels. In this way, each host computer will be accessing separate logical units.

To Connect the Components:

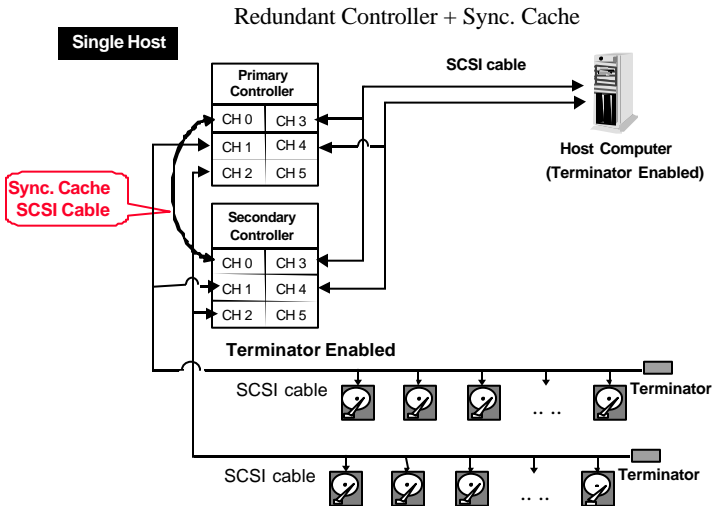
1. Make sure power is off and the power connector is disconnected.
2. Connect host channel(s) of the controller to the host system's SCSI port using a LVD compatible external SCSI cable as recommended by the HBA vendor. Usually it is necessary to connect from the controller to the outside of enclosure.
3. Make sure the host side of the SCSI cable is properly terminated.
4. Assign a unique SCSI ID for every hard disks that are to be connected on the same SCSI cable; between ID numbers '0' and '6' or '8' and '15.' The controller itself takes SCSI ID '7' on all channels.
5. Connect the other end of the drive-side SCSI cable to one of the remaining channels on the controller.
6. Connect the connectors located at the middle of the drive SCSI cable to the hard drives.
7. Terminate the SCSI cable by installing an external terminator on the last connector. Terminators on all the hard drives must be removed or disabled so that removing a hard drive will not affect channel bus termination.

NOTE:

Channel 0 is the default host interface using ID number '0.' Any of the channels can also be set as the Host interface. More than one channels can be set as the host interface when operating with redundant host or multiple host systems.

Single Host (Dual-HBA) Redundant Controller Configuration

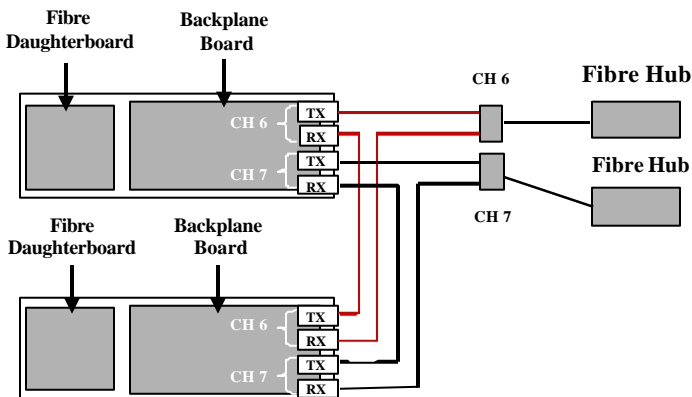
The example below shows a redundant controller configuration using two controllers and a dedicated SCSI channel for the synchronized cache communications between. Data cached in memory will be constantly synchronized between controllers to ensure there is no data inconsistency after a controller failure. Drive channels are terminated by external terminators. Using two HBAs is recommended for data path redundancy. Host software support is required to distribute I/O traffic between the two adapters; or, in case of HBA failure, direct I/O traffic from one to the other. Also refer to the *Generic Operation Manual* that came with your controller for details on how to setup redundant controllers.



Fibre-to-SCSI Redundant Controller Configuration

Integrators can choose an optional daughterboard to add two Fibre channels to the controller. This allows the SentinelRAID to operate in a Fibre channel configuration such as the Storage Area Network. Available SAN functions are LUN-Filtering (RAID-based Mapping) and full-duplex support.

Currently, two Fibre channels are necessary for an active-active configuration because each Fibre chip (processor) supports single loop ID. Each active controller will have to use one Fibre loop for connection with a host adapter. A dual-loop connection to host is also recommended for maximum performance. With proper host driver support, the two Fibre loops can be configured as the redundant data paths for extra redundancy. A Fibre hub is usually required for each loop if a multiple-host configuration is preferred.



As diagrammed above, use 3Px2-to-DB-9 and 3P-to-3P copper cables (e.g., IFT-9507) to connect the Fibre channels between two controllers. In active-active mode, each of the Fibre channels on a controller can be designated as the active data route; while the other Fibre channel will serve as the standby for the same channel that is active on the pair controller. With bypass circuits, signals directed to a failed controller can be bypassed to the standby channel on the alternate controller.

To enable the controllers in active-active mode, you need to assign different logical units to different controllers. Please refer to the

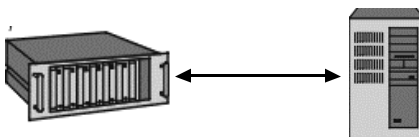
Generic Operation Manual that came with your controller for more details.

Supported Fibre Topologies:

1. Point-to-Point Topology:

Point-to-Point Topology: direct server-to-storage connection.

The connection between RAID system and host computer has the dedicated bandwidth. If using dual loop configuration for host I/O access, the host-side management software should support switching to a redundant data path in the event when one of the data paths fails.

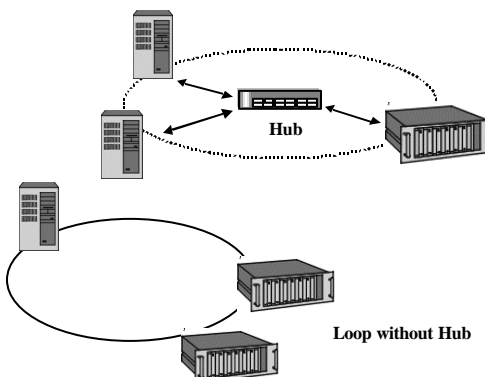


Point-to-Point

2. Loop and Hub Topology:

FC-AL, Private Loop Topology: a Fibre Hub is required. A Fibre Hub can be the center of a Fibre loop in which multiple servers can share the access to one or more storage devices (RAID system).

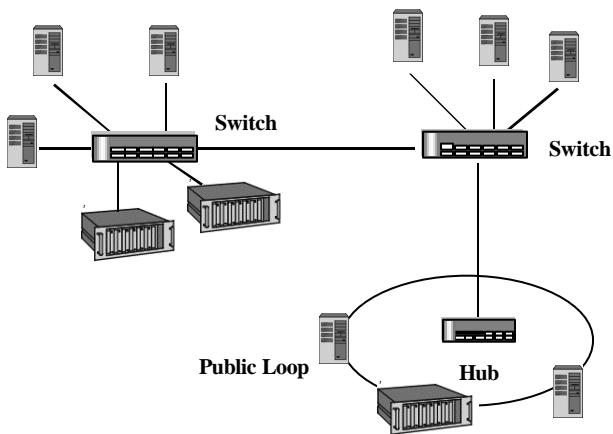
A Fibre hub functions as an arbitrator for accesses to data. Total bandwidth is shared via an arbitration scheme among every node-to-node connection. An example of private loop is shown below.



Loop without Hub

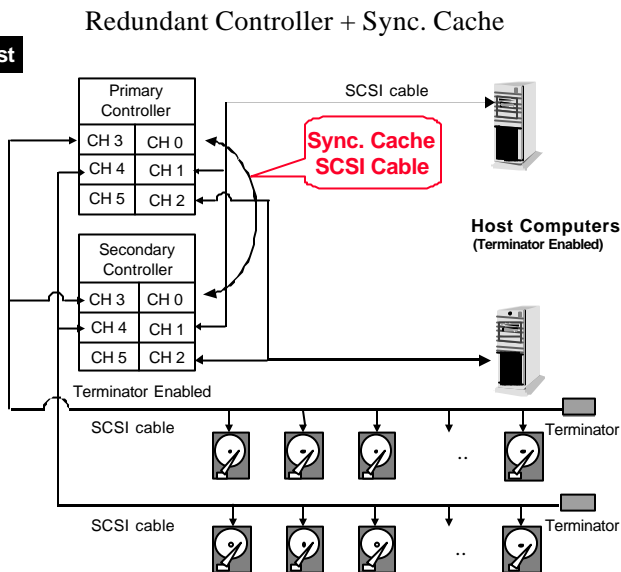
3. Switched Topology:

Every node communicates with another via a Fibre switch. A switch provides scalable bandwidth to the connection between nodes. Shown below is an example of switched fabric and a public loop. If two SentinelRAIDs are to be configured into redundant mode and connected to a switched fabric, configure the two controllers in a public loop before attaching them to a fabric. Two controllers can failover and failback in a Fibre loop but not in a switched fabric. A public loop is a Fibre loop built around a Fibre Hub and the connection is further extended to a switched fabric. If using the SentinelRAID 2000R3 controller, point-to-point connection to ports on a Fibre switch is supported.



Dual-Host Redundant Controller Configuration

Dual Host



Channel	Status
0	Synchronized cache communications path
1	Host channel
2	Host channel
3	Drive channel
4	Drive channel

As diagrammed above, a host computer is connected to channel 1 on both controllers, and the other host computer is connected to channel 2 on both controllers. Drives are also connected to the same channel on both controllers. Use a SCSI cable to connect channel 0 on both controllers. Enable the redundant controller function, and the controllers will automatically start negotiating with each other and synchronizing cached data after the system reboots.

All other channels can be designated as either host or drive through firmware setting. This means that you can have as many as 6 drive channels or 6 host channels. Multiple host configuration ensures data access with host clustering deployment and avoid compatibility problem between systems. Each host can be using one or two HBAs. When the array is shared by two systems, different logical units

(logical configurations of drives) can be mapped to different systems to prevent data corruption if the operating systems does not support file locking.

Except channel 0, all channels are configured as drive channels by default. Change channel mode through one of the configuration utilities if you want to configure specific channel as a host channel.

3.5 Software Utilities

Requirements for Using the Configuration Utilities:

There are different ways to configure a RAID system: LCD front panel, firmware embedded configuration utilities, and the Java-based GUI RAID manager.

1. LCD front panel does not require any preparation.
2. Firmware embedded configuration utilities: the RS-232 communication between host computer (or any computer used as management platform) and RAID controller should be first established.
3. The Java-Based GUI RAID Manager is supported via In-band or Out-of-band connection. The management platform communicates with the controller through the host I/O channel using the In-band SCSI protocol. Newer controllers since PCB version 2.7 also support communication via Ethernet port. If connected via In-band, host-side parameters should be adjusted before the host computer can see the controller. This is especially the case when users begin storage configuration with the GUI manager.
4. The GUI manager is not provided in kit. Users may acquire the manager from system vendors or download the program from Infortrend's ftp sites.

3.5.1 In-Band SCSI

What is it and why do you need it?

The GUI manager can use SCSI or Fibre cabling and protocols to manage a RAID controller. However, the host computer will not be able to locate the controller unless the controller is defined as a peripheral device or logical units have been mapped to host LUNs through other means of configuration.

How does it work with the SCSI cable?

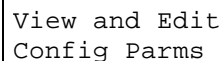
In-band SCSI technology translates the original commands into standard SCSI commands. These SCSI commands are then received by the RAID controller. It can be used to communicate between host management software and controller. The Java-Based GUI RAID Manager can administrate the RAID controller via the existing SCSI or Fibre I/O path. (Note: It is assumed that users of In-band SCSI possess the following: a third-party SCSI adapter and a channel on their Infortrend RAID controller that can be designated as a host channel). Both of these are required for In-band SCSI communication between the host and the RAID controller.

How Do You Configure the Controller to Use In-Band SCSI?

RAID Controller Adjustments

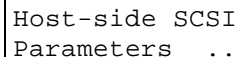
Use the front panel to configure the In-band SCSI settings.

From the Main Menu, press ▼ or ▲ to select "View and Edit Configuration Parameters."



View and Edit
Config Parm's

Press [ENT] and use the ▼ or ▲ to select "Host-side SCSI Parameters," then press [ENT] to proceed.



Host-side SCSI
Parameters ..

You may need to make adjustments in the following four submenu's: Peripheral Device Type, Peripheral Device Qualifier, Device Support

for Removable Media, and LUN Application. Different host operating systems require different adjustments. As a general rule, default values should not be changed except the Peripheral Device Type. Find in the table below the proper settings for your host operating system.

**Peripheral Device Type Parameters
for
Various Operating Systems:**

Operating System	Peripheral Device Type	Peripheral Device Qualifier	Device Support for Removable Media	LUN Applicability
Windows NT® 4.0	0x1f	Connected	Disabled	All Undefined LUNs
NetWare® 4.x/Windows2000	0x03	Connected	Disabled	All Undefined LUNs
SCO OpenServer 5.0x	0x7f	Connected	either is okay	All Undefined LUNs
SCO UnixWare 2.1x, UnixWare 7	0x03	Connected	either is okay	All Undefined LUNs
Solaris (x86 and SPARC)	0x7f	Connected	either is okay	All Undefined LUNs
Linux	0x03	Connected	Enabled	All Undefined LUNs

Cross Reference for the Meaning of Peripheral Device Type Settings:

Device Type	Setting
No Device Present	0x7f
Direct-access Device	0
Sequential-access Device	1
Processor Type	3
CD-ROM Device	5
Scanner Device	6
MO Device	7
Storage Array Controller Device	0xC
Unknown Device	0x1f

Configuration Example: Settings for Windows NT 4.0

The setting for Windows NT 4.0 is provided here as an example. For other operating systems, please refer to the table above.

On the front panel, use ▼ or ▲ to select "Peripheral Device Type Parameters"; and then press **[ENT]**.

```
Periph      Dev
Type Parameters
```

(For this example, we assume that there are currently no peripheral devices.)

```
Device Type -
No Device (0x7f)
```

Press ▼ or ▲ to choose "Unknown Device - 1f".

```
Set Device Type?
Unknown (0x1f)
```

Press **[ENT]** to confirm the selection. Use the arrow keys to scroll down to Device Qualifier, press ▼ or ▲ to select "Device Qualifier Connected. "

```
Device Qualifier
Connected
```

The default setting is "Connected." If your Front Panel reads "Disconnected," press **[ENT]** and you will be prompted to change to "Connected." If your Device

Qualifier setting reads "Connected," press **[ESC]** to return to the Host-side SCSI submenu's.

Use the ▼ or ▲ to select "Support for Removable Media." The default setting is "Disabled." If the LCD reads "Enabled," press **[ENT]** and you will be prompted to accept a change. If the screen reads "Disabled," press **[ESC]** to return to the Host-side SCSI submenu's.

```
SupportRemovable
Media - Disabled
```

Press ▼ or ▲ to select "LUN Application;" and then press **[ENT]**. The default setting is "All Undefined LUN."

```
LUN Application-
All Undefined LUN
```

Press **[ENT]** and use ▼ or ▲ to select "Undefined LUN-0's."

```
Applies to      ?
Undefined LUN-0's
```

Press **[ENT]** to accept. The screen should display the following message.

```
LUN Application-
Undefined LUN-0's
```

The RAID controller adjustments necessary to use In-band SCSI have been completed.

3.5.2 Out-of-Band via Ethernet port

Infortrend's Java-based manager, RAIDWatch, can communicate to the controller via Ethernet port. Controller management via Ethernet port is available under the following conditions:

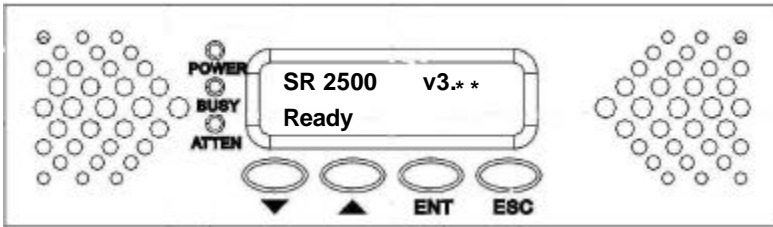
Controller (main board) PCB version	2.7 and above
Backplane (I/O board) PCB version	1.3 and above
Firmware	3.21 and above

You may obtain the management software from your system providers or download the management program from Infortrend's FTP sites.

Follow the steps listed below to manage the controller through Ethernet port:

1. Connect Ethernet port to the outside of the enclosure using the included IFT-9537 Ethernet cable and then to a hub. The receptacle side of this cable can be installed on enclosure back panel.
2. Assign an IP address to the controller (via LCD keypad or terminal emulation utilities). Also enter appropriate Net Mask and gateway values. Reset the controller for the configuration to take effect.
3. Before creating logical drives, make sure the preserved disk space has been removed from individual disk drives. You will be able to assign a reserved capacity to a logical drive during the configuration process. Wait until the drive formatting process (of the preserved capacity) is completed. The controller uses preserved disk space on logical drives for storing software modules.
4. The controller will take a while formatting a small storage sector for the manager programs. Wait until the formatting process is completed.
5. FTP the RAIDWatch Manager programs (grm.jar and grm.htm) to the IP address designated for the controller. Multi-language definition profile (IFTBundle_0.str) should also be available on the controller. The software help files are optional.
6. Primary and Secondary agents are not necessary here. However, NPC and Event Monitor should be installed and running on a host computer.
7. You can now start your browser and access RAIDWatch manager by entering controller IP address followed by grm.htm as your URL (e.g., 222.212.121.123./GRM.HTM). To access the manager program via browser, support for Java applet should be enabled on the management station.

3.5.3 Quick Start



Key:

[ESC] = Pressing the Escape key

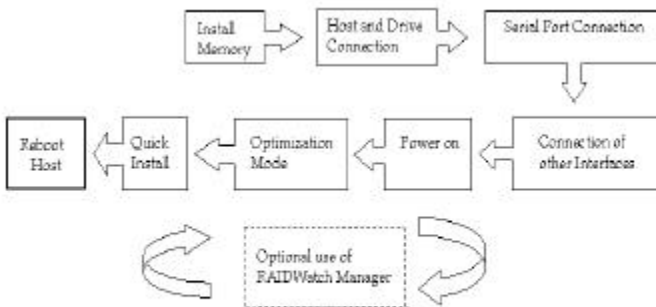
[ENT] = Pressing the Enter key

[▲] = Pressing the Up Arrow key

[▼] = Pressing the Down Arrow key

“XXX” = LCD Panel text is in quotes

XXXX = Variable Info is underlined (i.e. drives/
Megabytes/ RAID level all depend on individual
configuration)



Quick Installation Flowchart

Quick start will include all the physical drives connected on all drive channels into one logical drive. The logical drive will be automatically mapped to the first available host ID/LUN.

Optimization for Random or Sequential I/O

Before creating a logical drive, you must decide what your application will be and then choose to optimize the configuration of your controller for “Random I/O” or “Sequential I/O.” The selection can be found in “Main Menu”/“View and Edit Configuration Parameters”/“Caching Parameters.” Reset the controller for the configuration to take effect. Please also refer to chapter 6 and chapter 8 of your *Generic Operation Manual*.

1. After adding memory , power on the controller. The LCD should read, “SR 2500 V3.** NO HOST LUN”
2. [ENT] for two seconds to “Quick Logical Drive Install ↓”
3. [ENT] to see “Set TDRV=8 with LG RAID5+Spare?” TDRV means the total number of drives.
4. Press [▲] or [▼] to select desired RAID level configuration, see the options below and also refer to the Generic Operation Manual:
 - RAID 5 + Spare
 - RAID 5
 - RAID 3 + Spare
 - RAID 3
 - RAID 1 + Spare
 - RAID 1
 - RAID 0
 - NRAID
5. [ENT] to select an option, for example, “RAID5+Spare”
6. LCD screen will read “Init Parity 24% Please Wait !” The percentage of initialization progress will be shown, front panel BUSY LED and enclosure hard disk busy LED(s) will be lighted. Note that the time it takes to initialize varies by selecting different RAID levels. Drive capacity and drive speed are also parameters of controller performance.
7. Upon completion, LCD will read “LG=0 Initialize Completed.” The logical drive will be automatically mapped to the first available host LUN.
8. [ESC] three times to main screen, “SR 2500 v3.** READY”

NOTE:

1. *You may need to reboot your Host to “see” or negotiate with the controller. When SCSI negotiation is complete, you will be able to partition and/or format the RAID. Once you have written data to the controller the front panel will no longer display the “READY” text on the second line.*
 2. *An abbreviation of model name will be displayed on LCD. SR is the abbreviation for SentinelRAID. You may setup a controller name to be displayed on LCD for ease of identification in a multi-RAID configuration. Please refer to your Generic Operation Manual for details.*
 3. *When the host computer resets, the Fibre adapter interface (if configured in Fibre-to-SCSI mode) will issue a “LIP” to the loop. According to the LIP, controller will display a warning message “CH_ Fibre Loop Failed.” This is normal during a host computer reset when powering on or disconnecting the Fibre cable.*
-
-

Chapter 4 Installation

4.1 Steps for the Hardware Installation:

1. Provide a static-free working environment. Turn off and disconnect all power to the host, hard disk drives, enclosure, and other components.
2. Install cache memory. Install DIMM's of the same size to both controllers in a redundant controller configuration.
3. Install the controller in server or enclosure and attach the SCSI/Fibre/serial cables and terminators as needed. It is recommended to use the on-board terminators for SCSI bus termination, please refer to section 4.7 to shunt terminator jumpers properly.
4. Make sure all cables are correctly attached in accordance with SCSI or Fibre specifications. Make sure the controller is properly installed. Turn power on after all components are correctly installed.
5. Install RAIDWatch manager or connect serial port to start terminal emulation. The manager can communicate with the controller via the existing host I/O path or RS-232. The requirements for the management software to communicate with the controller are:
 1. The controller is configured as a peripheral device.
 2. Logical units have been created (logical configurations of drives) in the storage system and mapped to Host ID/LUNs.

If you want to use RAIDWatch to start system configuration, host computer can communicate with the controller through SCSI/Fibre connection using in-band SCSI protocol. You may also choose to start configuring your RAID using front panel keypad or firmware-embedded manager through RS-232 connection.

6. RAIDWatch can also be started via Ethernet connection. This feature is supported with newer release of SentinelRAIDs (PCB v.2.7 and above). Please refer to Chapter 3 "Software Utilities" for more details.
7. Configure and initialize your RAID.

WARNING!

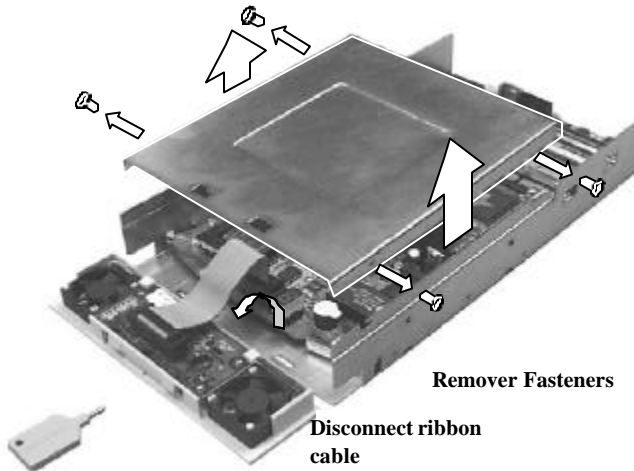
Before proceeding on controller installation, disconnect the system (an enclosure, for instance) from the electrical outlet before opening the system cabinet. Working with electrical power attached to the system can result in shock and injury.

4.2 Removing Controller Top Cover

1. Remove the controller carefully from its package; or, if you are upgrading controller memory, turn off all power to host computer and power down your RAID enclosure. If you are installing components to a new controller, jump to step 3.
2. After you turn off the controller power and unplug the power cords, remove the controller from the enclosure cabinet or chassis where it is located.
3. Use the bezel key provided with your controller or a straightened paper clip to remove the front panel. Insert the bezel key into the ejection hole in the middle of front panel and lever down to remove from chassis.
4. Disconnect the 34-pin ribbon cable from the front panel module.



5. Remove fasteners from controller top cover and then remove it.



Removing front panel and controller top cover

6. When top cover is removed, you may continue with installing or upgrading controller components.

4.3 Installing/Upgrading SDRAM DIMM

CAUTION:

- *Do not remove memory from the anti-static bag until you are ready to install. Do not lay memory on top of the anti-static bag. Only the inside of the bag is anti-static.*
 - *Static electricity can damage electronic components, including SDRAM. Before touching the memory module, discharge your body's static electric charge by touching a grounded surface.*
 - *Handle memory cards by holding their edges.*
 - *Avoid touching chips and connector pins.*
 - *Avoid carpet, plastic, vinyl, styrofoam in your work area.*
 - *Make sure all components are room temperature before working with them.*
-

The following are guidelines on using SDRAMs:

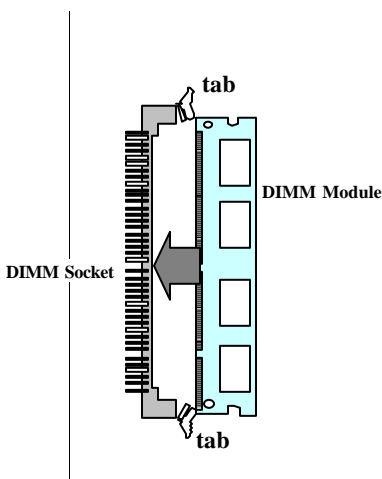
- ✓ *The SentinelRAID series controller requires a minimum of 32 Mbytes SDRAM DIMM (with or without parity function) installed in the DIMM socket in order for it to operate. The controller is normally delivered without any SDRAM installed.*
- ✓ *Use 168-pin SDRAM DIMM module. SDRAM DIMM that meets Intel PC-100 or PC-133 standard is recommended.*
- ✓ *A DIMM with or without ECC support, can be auto-detected by the controller. A DIMM with parity is recommended for security.*
- ✓ *The minimum SDRAM required is 32Mbytes installed in a DIMM socket, however, greater memory size is recommended.*
- ✓ *The controller supports DIMM modules with the capacities between 32MB and architecturally up to 1GB.*

WARNING!

Do not attempt to install, remove, or upgrade a SDRAM DIMM on the controller with the battery installed. Damage to the controller components will occur.

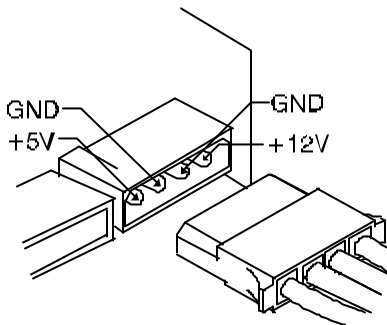
To install the SDRAM DIMM:

- 1.** Before installation, make sure there is no power connected to the controller and anti-ESD methods have been applied. Before installation, you have to remove controller main board from the controller chassis. Please refer to section 4.6 for details on how to remove controller main board.
- 2.** Remove daughterboard and battery module before installing or replacing DIMM's. Grab the edges of your daughterboard/battery daughterboard and pull carefully to remove it from the respective sockets.
- 3.** Pull the tabs at the ends of the DIMM socket aside.
- 4.** Position the DIMM toward the socket with the notches in the module aligned with the keys on the socket.
- 5.** Insert the module horizontally into the socket. The tabs will hold the DIMM in place.



4.4 Power Connection

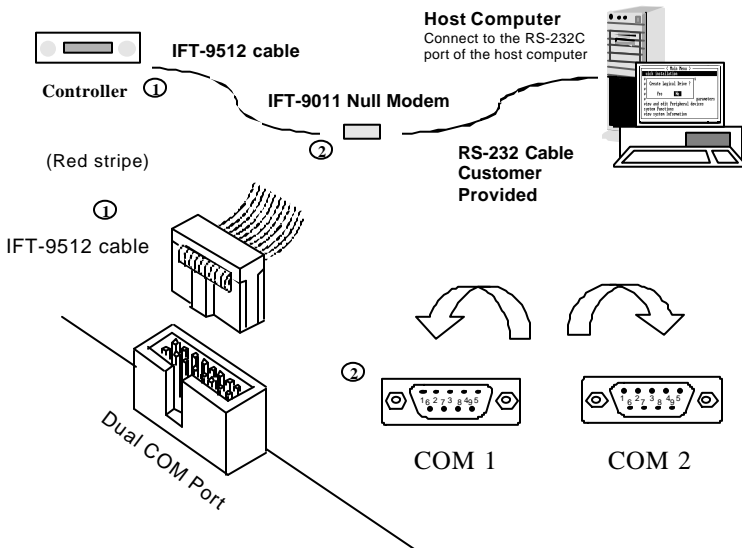
The power input and connection of the controller is exactly the same as those for hard disk drives. Be sure to connect **both** connectors. The power connection is shown below.



4.5 How to Connect RS-232C Terminal Emulation

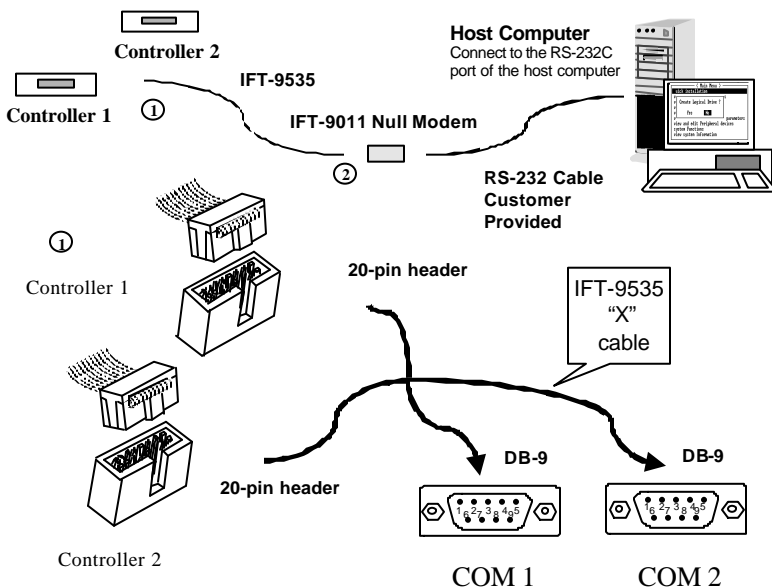
The controller can be configured via a PC running a VT-100 terminal emulation program, or a VT-100 compatible terminal. The provided combo cable (IFT-9512) converts the RS-232 signals from the 20-pin header into the two 9-pin D-Sub male connectors. The pin layout of the 9-pin connectors is similar to that of a PC's serial port and is set as a DTE device. The proper connection of the cable is displayed in the following diagram. The DB-9 connectors of IFT-9512 cable are marked as "COM 1" and "COM 2." Please use the connector marked as "COM 1" for terminal emulation. Connect COM 1 to the included Null Modem (IFT-9011) and connect the other end of the Null Modem to the outside of your enclosure or to an external RS-232 cable. COM ports can also be used for connecting to a modem for remote configuration. COM 2 can not be used to download firmware.

The dual redundant solutions SentinelRAID "R" series also uses this cable for serial port connection. Signals are connected between controllers over the system backplane.



In Redundant Mode: IFT-9535 "X" Cable

An "X" shape cable (IFT-9535) is required to connect the serial ports on both controllers to a management platform when configuring two independent controllers into the redundant mode. The theory behind this is that, if one of the controllers should fail, the existing controller can obtain the signal path to respond to the configuration commands from host computer. The existing controller also needs to notify system administrators with system events. Whether in normal condition or degraded mode (the surviving controller serving all I/O requests), only the controller designated as the primary controller responds to user's configuration. However, it is not predictable whether the primary or the secondary controller should fail. The cable connects to both controllers. Should any of the two controllers fail, the existing controller will obtain the signal path and respond as the primary. The cable has two 20-pin male headers and two standard DB-9 serial connectors.



The following are guidelines on using the serial port:

- The serial port's default is set at 38400 baud, 8 bit, 1 stop bit and no parity.
- In most cases, connecting RD, TD, and SG is enough to establish communication with a terminal.
- If you are using a PC as a terminal, any of the VT-100 terminal emulation software will suffice. Microsoft® Windows includes a terminal emulation program with the "HyperTerminal" icon in the Accessories menu.
- When using Hyper Terminal in Windows 2000, due to its mis-interpretation, the arrow keys might not work properly. The following key combinations can be used instead:
 - Ctrl-J = Down arrow
 - Ctrl-K = Up arrow
 - Ctrl-H = Left arrow
 - Ctrl-L = Right arrow

The baud rate can be changed using the front panel. To change the baud rate:

Press **ENT** for two seconds to enter the Main Menu. Press ▼ or ▲ to select "View and Edit Configuration Parameters," then press **ENT**.

```
View and Edit  
Config Params  ↑
```

Select "Communication Parameters," then press **ENT**.

```
Communication  
Parameters ..
```

Select "RS-232C Configuration," then press **ENT**.

```
RS-232C  
Configuration ..
```

Select "COM1 Configuration," then press **ENT**.

```
COM1  
Configuration ..
```

Select "Baud-rate 9600..," then press **ENT**.

```
Baud-rate 9600  
..
```

Press ▼ or ▲ to select the baud rate, then press **ENT** for two seconds to confirm the selected baud rate.

```
Baud-rate 9600
Change to 38400?
```

- The following baud rates are available: 2400, 4800, 9600, 19200 and 38400. Baud rate settings on the controller and on the terminal must be identical.

4.6 Controller Main Board Removal and Replacement

As a general rule, the controller main board should never be removed. The components on the board can be damaged by improper handling or electrostatic discharge (ESD).

It is only necessary to remove the controller main board in the following two conditions:

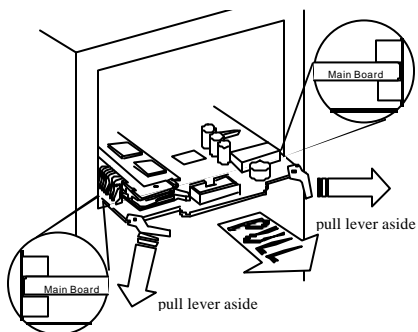
- a) Redundant controllers are in use and one of the controllers has failed.
- b) Single controller in use and the controller has failed. Remove the main circuit board and replace it with a new one.

If the controller main board needs to be removed for any other reason, system vendor should be contacted for assistance.

4.6.1 Controller Main Board Removal

1. To prevent damage to components, apply electrostatic protection methods.
2. Power down your RAID system.
3. Use the included bezel key to remove front panel. Insert bezel key into the ejection hole located at the top center of the controller front panel and lever down to remove the panel. You must then remove the gray ribbon cable connected between front panel and controller main board.

4. Pull the “eject levers,” located at the front of the controller main board, to the side. Make sure to pull each lever outwards as far as it will go.



5. You may now pull out the controller's main board.



4.6.2 Controller Main Board Replacement

1. To prevent damage to components by ESD, it is recommended that an anti-static wristband be worn.
2. Gently slide the main board into the enclosure. Make sure controller main board reaches the end of controller chassis and is inserted properly into the metal grooves on each side of the enclosure.
3. Push eject levers toward the center, moving them inward as shown below. Also make sure the square-shaped notches on eject levers lock onto the edge of the metal groove.



4. Connect LCD ribbon cable between main board and front panel module.
5. Install the front panel module back to its original position by pushing it gently into the front opening of controller chassis. You should be able to hear a “click” sound when tenens on front panel are joint with mortises on controller chassis.

4.7 How to Install Daughterboard/ Daughterboard Backplane

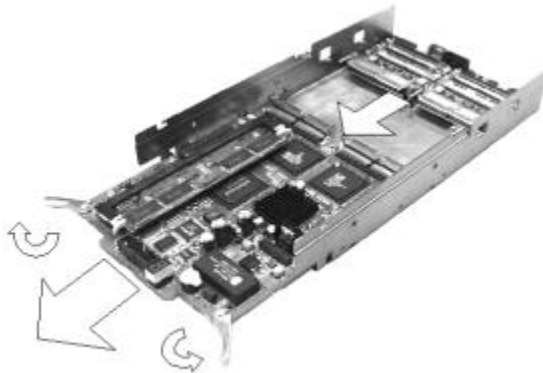
1. Daughterboards add additional SCSI/Fibre channels to your RAID controller. An interface backplane should also be installed along with the daughterboard. The appropriate combinations of daughterboards and backplanes are listed below:

	Ultra2 x 4/ Ultra160 x 4	Ultra2/Ultra160 x 2 & 1G Fibre x 2	1G Fibre x 2
Daughterboard:	IFT-9284U2/ IFT-9284U3	IFT-9284U2F/ IFT-9284U3F/	IFT-9282F
Daughterboard Backplane:	IFT-9288B4	IFT-9288B4U2F	IFT-9288B2F

	Ultra160 x2 & 2G Fibre x 2	2G Fibre x 2
Daughterboard:	IFT-9284U3F2	IFT-9282F2
Daughterboard Backplane:	IFT-9288B4U3F2	IFT-9288B2F2

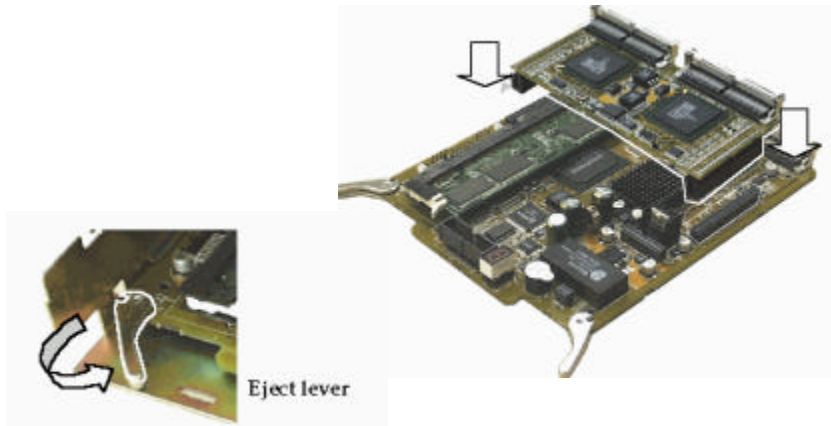
2. When two controllers are configured in redundant controller mode, it is a must to shut down the host computer(s) and both the primary and the secondary controller to upgrade with daughterboard installation.
3. Discharge static electricity by touching a grounded and unpainted metal surface or by wearing an anti-static wristband.
 - *Do not remove components from the anti-static bag until you are ready to install.*
 - *Handle components by holding its edges and avoid touching chips and connector pins.*
 - *Make sure all components are room temperature before working with them.*
 - *Use screws on the mounting positions or those provided by Infortrend only (M3, 5.6±0.3mm in length). Longer screws may cause electric shorting.*

4. Disconnect power cords from the back of the controller.
5. Remove controller front panel and top cover from controller chassis. First, use the included bezel key or a straightened paper clip to remove front panel. Insert bezel key into the ejection hole in the middle of front panel and then lever down slightly to remove it. Disconnect ribbon cable from the front panel. Second, unscrew the fasteners on top cover and then remove it.
6. Use eject levers in the front of main board to disconnect docking connectors and remove controller main board.



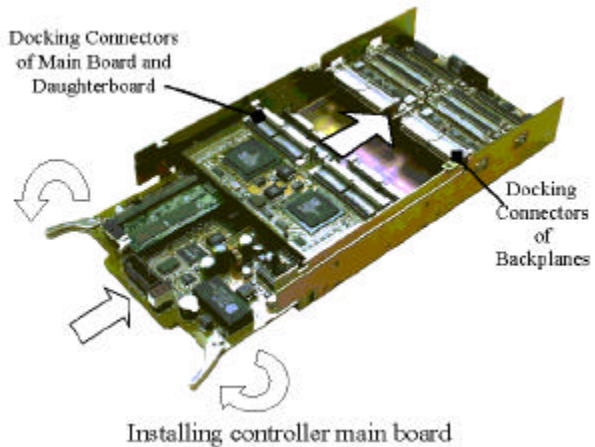
Removing controller main board

7. Please note that screws are already fastened to the associated mounting positions. Mount the daughterboard backplane to controller chassis by positioning it to the four mounting positions. Install backplane board to controller chassis by fastening the four M3 screws.
8. Locate the daughterboard upgrade sockets (JP 12 & JP 13 72-pin receptacle connectors) on controller main board. Install your daughterboard by orienting and plugging its headers into the upgrade sockets. Position and press down firmly until the daughterboard fits into place. Remember to orient the docking connectors on daughterboard towards the rear side of controller. If properly installed, plugs and receptacles will be mated between daughterboard and its backplane when controller is inserted into chassis.



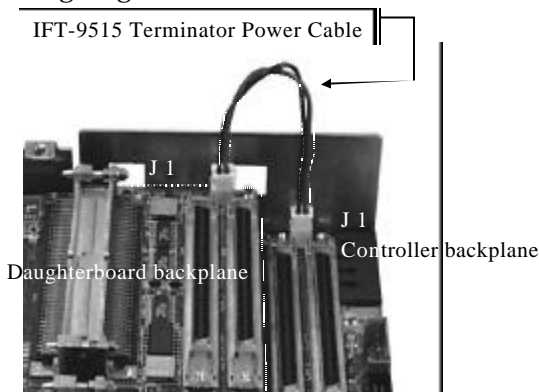
9. Gently slide the main board into chassis. Make sure the main board reaches the end of chassis and is inserted properly into the metal grooves on each side of the controller chassis.

Push the eject levers towards the center, moving them inward as shown below. Also make sure the square-shaped notches on the eject levers lock onto the edge of the metal groove. The "docking plugs" on daughterboard and main board must be mated to the docking receptacles on controller backplane and daughterboard backplane.



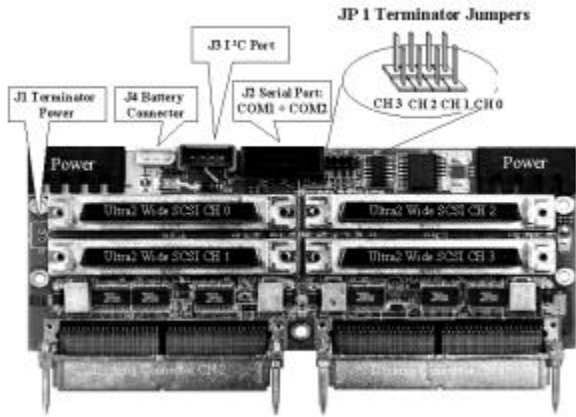
10. When installed with a SCSI daughterboard, attach J1 on controller backplane to J1 on daughterboard backplane with the **IFT-9515** linking cable. This cable is provided with the daughterboard backplane. The connection between these two headers provides a sustaining 5 V power to the terminator circuits on daughterboard backplane. The connection is necessary under the condition when the controller fails and has to be removed from a redundant controller system (see the diagram below).

Please refer to the following diagrams to locate J1 and JP1.

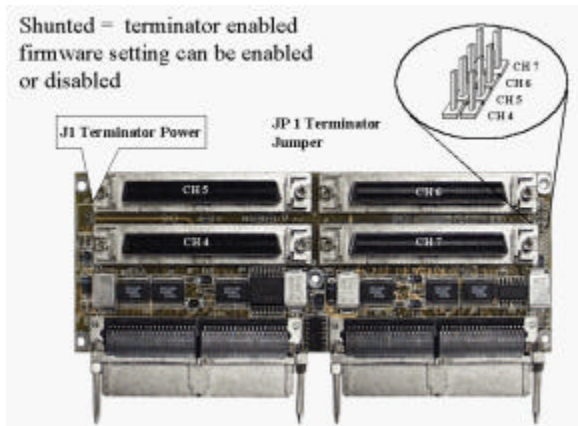


Connecting IFT-9515 terminator power cable

11. **Terminator circuits** are provided on interface backplanes. Configure JP 1 jumpers to force enabled (jumper pins shunted) SCSI termination of the associated SCSI channel(s). The on-board terminators can be used in redundant controller configuration as long as they are enabled by jumper setting. **DO NOT** rely on firmware configuration for controlling SCSI bus termination under this condition, because once a controller is removed, firmware control is lost. Shunt the associated jumpers to enable the on-board terminators. On the other end of a SCSI channel, you can choose to use an external terminator or the built-in terminator on a drive canister backplane. SCSI buses attached to the interface backplanes remain unaffected even when one controller fails and the failed controller is swapped out.



Connectors and terminator jumpers on controller backplane



Connectors and terminator jumpers on daughterboard backplane - locations of the terminator power are similar on all SCSI backplanes.

12. Fasten the top cover back to its original position and connect the LCD front panel ribbon cable. Install front panel back to the controller chassis. Attach power cords and SCSI/Fibre cables to the connectors of the associated channels. Connect other interfaces to the controller: RS-232C, I²C, etc. If you have removed the controller from an enclosure, follow the instructions provided by system vendor.

13. When finished with hardware installation, you may refer to Infotrend's *Generic Operation Manual* for instructions on how to configure your RAID. If your controller initializes successfully after

the installation, you will be able to start “View and Edit SCSI Channel” to see if your newly-added channels have been correctly recognized by your controller.

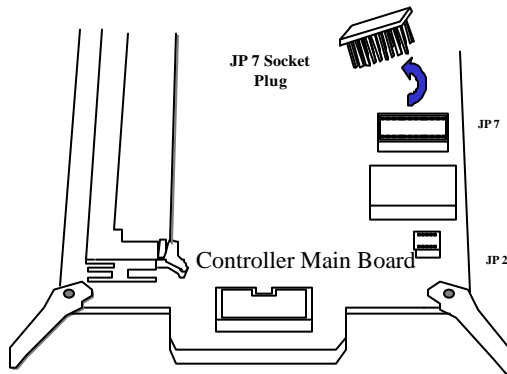
4.8 How to Install/Replace Battery Backup Module

The controller operates using cache memory. However, if the controller operates with write-back caching and power failure occurs, the cache memory may contain buffered data that has not been made permanent on hard disks. The buffered data is not retrievable when power returns unless a backup power is provided. The combination of the IFT-9070C and IFT-9010C allows two battery packs to be daisy-chained for longer backup time and can sustain power supply longer than 72 hours. The IFT-9519 extension cable can be applied to cascade multiple cell packs or to extend the connection between controller and cell pack.

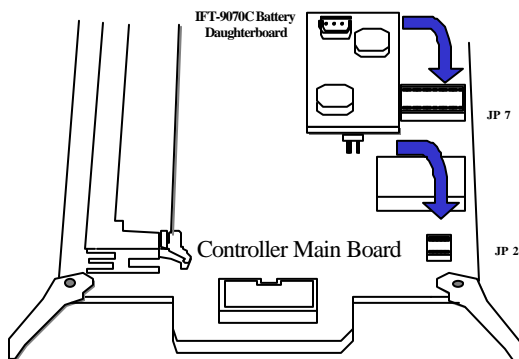
Each battery in the cell pack has a storage capacity of 3A/H when fully charged, and three cells are used for a total of 3.6V source. The charger circuit on IFT-9070C provides a 160mA charge until: 1. a time limit of 90 minutes is reached; 2. a temperature limit of 65°C is reached. After fast charging, the charger will shift to a trickle stage until the charge is full.

To Install the IFT-9070C Battery Backup Daughterboard and IFT-9010C Battery Cell Pack:

1. Make sure all power to the controller and drives are disconnected. Provide a static-free environment in your working area.
2. Remove controller main board from your enclosure (refer to section 4.5).
3. Locate the BBU socket plug (loop-back circuit) that is inserted in the female pin socket JP 7.



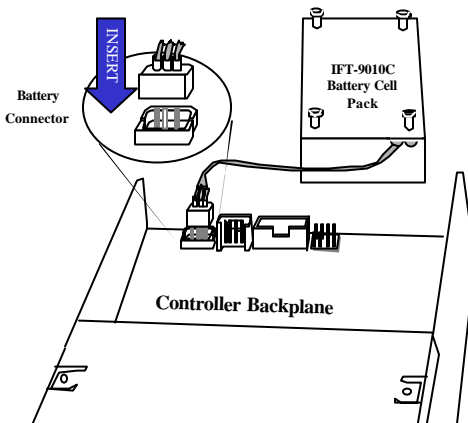
4. Remove the socket plug that is on JP7 (keep the socket plug for future use). Pin socket JP7 must be installed with either the socket plug or the daughterboard (charger circuit).



5. Install the IFT-9070C daughterboard onto the controller main board.

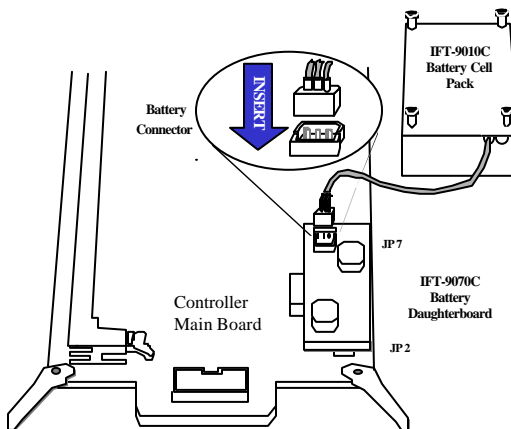
6. There are two ways to connect a cell pack. Either of the linking cables on the cell pack can be used. The shorter one is usually applied for cascading another cell pack.

- 1 Connect the cell pack to the 3-pin battery connector (J4) on controller backplane.



Connecting to the 3-pin battery connector on controller backplane

- 2 Integrators may provide pre-drilled holes in their canister for securing the cell pack using its four mounting positions. The disadvantage of a direct connection between cell pack and charger circuit is that you will have to disconnect cell pack before removing the controller.



Connecting to the battery daughterboard

WARNING!

Be careful to properly insert the pins on the IFT-9070C daughterboard. All of the pins should be seated in the female pin sockets JP7 and JP2. Failure to properly insert the pins may result in serious damage to the controller.

7. Remember to attach the included plastic plug to the unused connector of cell pack with the precaution that pins of an unused connector may be shorted to enclosure bulkhead.

IMPORTANT!

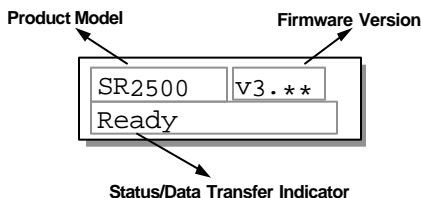
You must install the socket plug back to JP7 once you have removed the IFT-9070C battery daughterboard. The controller will not work if you fail to do so.

Notice for First Installation:

1. It is possible that the linking cable connected between IFT-9070C daughterboard and IFT-9010C cell pack would have a surface contact with components on the controller main board. While routing the linking cable from one side to the other, please take it into your consideration that some chip surfaces should be avoided. The surface temperature on chips like SCSI/Fibre processors may rise and damage the plastic shielding of a linking cable.
2. Battery has a tendency to "remember" its capacity. In order to make use of all the capacity of your battery cells, allow the battery cell pack to be fully charged when installed for the first time. The first time charge of battery cells takes about 24 hours to complete. When the installation of battery module is completed and the controller is powered on, the battery will automatically start charging. Do not turn off the controller power during the first 24 hours. Once the controller power is turned off, and there is unwritten data in cache memory, the battery will start discharging.
3. Inspect regularly and replace every **TWO** years; use official battery pack replacement and use with specified RAID controllers only.
4. Be sure to disconnect battery module before replacing DIMM module.
5. During normal use, an empty IFT-9010C takes about 20 hours to recharge.
6. Disconnect battery module if there is a long storage period before deployment. Extreme storage condition should be avoided (temperature: $>-20^{\circ}\text{C}$ or $<65^{\circ}\text{C}$, relative humidity: $<65\% \pm 10\%$).

Power on the Storage Subsystem

1. Power on the RAID system. If the SCSI buses are properly installed and terminated, you should be able to hear the disk drives inside when they are spinning-up. Follow the boot device procedure as provided by the enclosure manufacturer. The RAID system should be powered on first before the host computer, since the RAID system usually takes a while to boot (waiting for the drives to be ready, then for the controller to be ready).
2. Normally all the storage will be used and should be ready before the host computer boots.
3. Wait for the controller LCD to indicate "READY" or "No Host LUN" before the host boots up.
4. Refer to the following diagram on how to read the LCD screen. The front panel LCD should light on. A few messages will appear on the LCD for a short while.



```
SR2500  v3.* *  
No Host LUN
```

This screen is accompanied by two "beeps."

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

This is a normal message if no logical drive has been created or no logical drive has been mapped to a host channel ID/LUN.

- OR -

```
SR2500  v3.* *  
Ready
```

This is a normal message when a logical drive has been created and mapped to a host channel ID/LUN.

5. For other screen messages, please refer to Chapter 5 of your *Generic Operation Manual* that came with your controller.

Chapter 5 Dual Redundant Chassis

The SentinelRAID 2000/2500 R1/R2/R3 controller series is an external, hot-swappable, and dual redundant solution based on the SentinelRAID controller architecture. The 5.25" full height chassis simplifies system integration with redundant controllers. The main chassis houses two independent



controllers and provides controller hot-swap capability for each. Each controller can be easily joint and removed via two docking connectors without signal glitches. Both controllers are hot-swappable: a failed controller can be replaced online.

In the past, integrating two independent controllers into the redundant mode meant complex cabling, configuration difficulties, and the risk of bus failure caused by cable disconnection. Cabling between the two controllers usually includes I/O paths, controller communications channel for cache synchronization, and the failover/failback signal connection. With these connections interfaced through a controller backplane, system integrators need only to connect host and drive I/O interfaces. No additional cable connections between the two controllers are required.

Solutions:

SentinelRAID 2000R1	Redundant 3 Ultra2 channels
SentinelRAID 2000R2	Redundant 4 Ultra2 channels
SentinelRAID 2000R3	Redundant 2 Fibre and 2 Ultra2 channels
SentinelRAID 2500R1	Redundant 3 Ultra160 channels

SentinelRAID 2500R2	Redundant 4 Ultra160 channels
SentinelRAID 2500R3	Redundant 2 Fibre and 2 Ultra160 channels

Automatic Redundant Controller Configuration:

Default settings are altered appropriately to reflect the redundant configuration. When controllers are installed, they will come online with settings that allow for normal operation in a redundant controller context. If these default settings do not fit with the external configuration (e.g. host versus drive channels), they can be modified manually.

Manual Redundant Controller Configuration:

Users may choose to configure the "R" series manually. The configuration procedure is similar to that of configuring two independent controllers into the redundant mode. Before two controllers can work as redundant controllers in an active-to-active operation, it is necessary to configure each controller separately. Start manual configuration by removing one of the two controllers from the main chassis. When both controllers are ready for redundant operation, install both into the main chassis. Controllers will come online after controller-controller negotiations.

Follow the steps listed below to configure your redundant controllers.

- 1.** Power down and remove all power cords from your controller, host computer, disk enclosure, and other components.
- 2.** Set different IDs to your drives and install them into the drive bays of your drive enclosure. Make sure your host and drive channels are properly terminated and the terminators on your drives disabled. Install an external terminator or enable terminator on the drive canister at the end of each drive channel.
- 3.** Use the eject levers to remove one of the controllers from the main chassis and start to configure the remaining controller.
- 4.** Connect host channel to host computer.

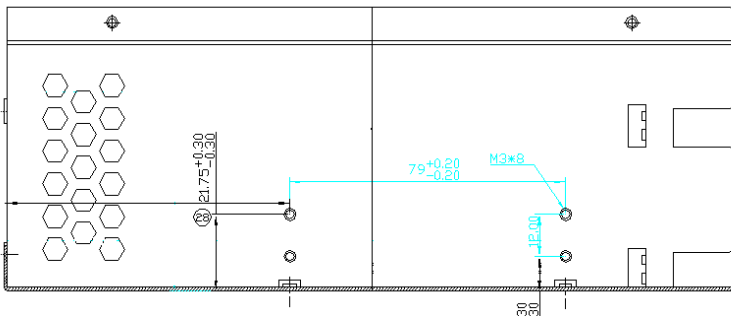
Port name: If host interface is Fibre channel (R3 configuration), you may need the port names of host adapters for configuring access control using the LUN Filtering function. Check the WWN number on your HBA card. Newer firmware releases from 3.14 and above support auto-detection of device WWN port names on host loops.

Controller unique ID: A controller unique ID is necessary for controller failover and failback over Fibre loop. Every controller is pre-configured with a controller unique ID. If the default ID is lost, enter different IDs from 1 to 65535 for each controller and IDs must be unique for each controller in the configuration.

5. Create logical drives, logical volumes, or divide them into logical partitions and create a primary ID and a secondary ID on drive channels. Set drive-side channel Primary ID as 9 and Secondary ID as 8. Assign logical units to either the primary or the secondary controller and map each logical unit to LUNs under primary controller ID or secondary controller ID on host channel.
6. Enable the "redundant controller" function from "View and Edit Peripheral Devices/Set Peripheral Device Entry" and set controller as the primary controller.
7. Remove the controller from the main chassis, then insert the other controller. Enable the "redundant controller" function from "View and Edit Peripheral Devices/Set Peripheral Device Entry" and set the controller as the primary controller. Set drive-side channel Primary ID as 9 and Secondary ID as 8.
8. Remove the controller from the main chassis, and then install both controllers into the main chassis. You may power down the system first, install both controllers, and then power on both together. Firmware will decide which is the primary and which is the secondary controller.
9. After the controller negotiation is completed, the host should be able to access the storage capacity in RAID. Please refer to the *Generic Operation Manual* for more details on redundant controller configuration.

Mounting:

The controller can be installed into standard 5.25" full-height cabinetry in a tower or rackmount enclosure. The relative locations of 8 mounting holes (4 on each side) are shown below. Use flathead M3 screws for securing top cover. Use M3 screws for all the mounting positions. Mounting screws should not extend 5.6 ± 0.3 mm. If controller is installed with a daughterboard, the part of screws driven inside controller chassis should not extend a 3-mm keep-out-area along the long sides of controller board.



Important Features:

The SentinelRAID "R" series supports active-to-active or active-to-standby redundant controller operation with synchronized write-back caching. All signals are connected between controllers and the controller failover/failback can be accomplished almost instantly. Failover and failback are transparent to host.

Features in Common:

The SentinelRAID "R" series uses a common controller chassis, front panel module, and the same accessories.

SCSI Termination:

It is recommended to keep the termination jumpers (JP 1) on the system backplane shunted instead of using firmware setting to control SCSI bus termination. This is the precaution against the loss of firmware control in the event of controller failure. The other end of host/drive channel should be attached with an external terminator or the built-in terminator activated on system backplane.

Ventilation:

Sufficient airflow must be maintained through the chip surfaces of the controller.

Infortrend RAID controllers use a convection-cooled processor; therefore, airflow across the heat-generating chips is required for operation within the normal temperature range. An enclosure providing sufficient airflow across the controller board surface is required. Controllers and drives should be operating under an ambient temperature below 50°C. The voltage safety tolerance is listed in Appendix A (A.6).

The following issues should be addressed:

1. The airflow through the controller should enter through the front panel and exit from the back.
2. Obstructions in the airflow path should be avoided. Be sure that airflow through the ventilation holes is not obstructed.
3. Preheated air from other equipments in the enclosure should not be drawn into the controller.

Battery Modules:

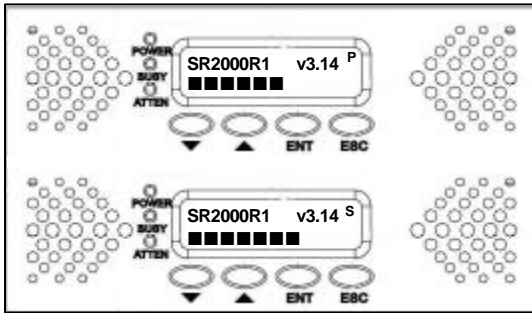
Identical to the SentinelRAID 2000/2500, the "R" series uses the combination of IFT-9070C battery daughterboard and IFT-9010C cell pack to protect cached data.

Installing Battery Modules:

To install battery modules, disconnect all power to the controller and remove both controllers from the main chassis. Install the IFT-9070C battery daughterboards (charger circuits) onto both controllers. Both controllers should be installed with independent battery modules. Insert controller main boards and connect IFT-9010C battery cell packs to J4 and J40 on system backplane.

Please refer to the previous chapter for more details on how to install a battery module.

Front Panel LCD Display:



The "R" controllers are equipped with independent LCD displays. Although the secondary controller does not respond to user's configuration, data throughput will still be displayed on LCD as a status bar. Each controller's operating mode will be indicated by the flashing digit on the upper right of the LCD screen as "P" or "S," primary or secondary respectively.

By default, the primary controller is always located on the top and the secondary on the bottom. If the primary controller should fail and is replaced afterward, the secondary controller will become primary and the relative locations of controllers will certainly be changed.

Front Panel Indicators:

Front panel indicators are the same as those of the half-height SentinelRAID 2000/2500, please refer to Chapter 3 for details. Each front panel displays the status of the relative controller.

DIMM Installation:

DIMM installation to the "R" series is the same as installing to a half-height controller. The size of cache memory must be the same on both controllers. Be sure that all power (including battery) is disconnected from the controller. Observe the same anti-ESD methods as described in Chapter 4.

Main Board Connector and Jumper Identification:

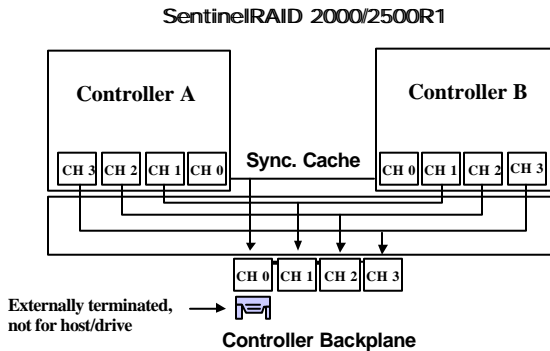
The connectors and jumpers on the controller main board are the same as those on the half-height SentinelRAIDs, please refer to Appendix D for details.

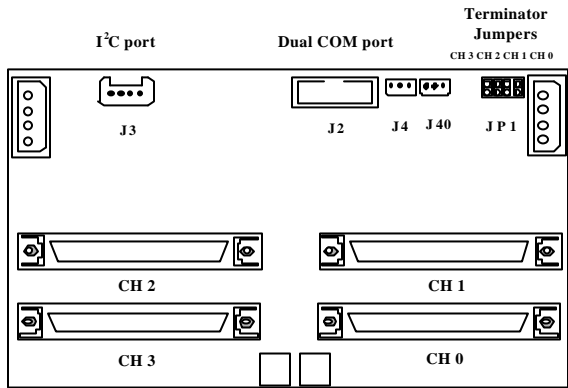
5.1 SentinelRAID 2000/2500R1:

Channel Bus

Each controller in this configuration uses channel 0 of the four SCSI channels as the communications path for synchronizing cache. The SCSI connector of channel 0 should be installed with the supplied external terminator. Also remember to shunt the terminator jumpers associated with channel 0. Channels 1 to 3 can be configured as host or drive interfaces. The default for host channel is channel 1.

All SCSI channels are connected between controllers through signal paths on the controller backplane and to the high-density connectors. The other interfaces are identical to those of the half-height controllers. Logical drives can either be assigned to one of the controllers and let the other serve as standby controller via firmware configuration. In the event that one of the controllers fails, the other will take over the entire host I/O loads within seconds and assume the role of primary controller.





Controller backplane: IFT-9288BH

Backplane Connectors:

ℳC port:

The ℳC interface is designed for the ISEMS (Infotrend Simple Enclosure Management Service). Firmware supports monitoring of remote enclosure devices (power, fan rotation speed, temperature, etc.) through SAF-TE, S.E.S., or ℳC interface. Via ℳC interface, controller collects signals from remote sensors and notifies system administrator if the signals exceed thresholds.

Battery Connector:

J4 and J40 are battery connectors. J4 connects to the controller of the upper location and J40 connects to the controller on the bottom. Battery modules are optional items.

Termination Jumpers:

Each of the I/O channels can be terminated by setting controller jumpers. To enable the terminators, shunt the terminator jumpers (JP 1) of the associated channel. To disable the terminators, leave the terminator jumpers of the associated channels open and remember to redefine the associated channels as "terminator disabled" through firmware configuration.

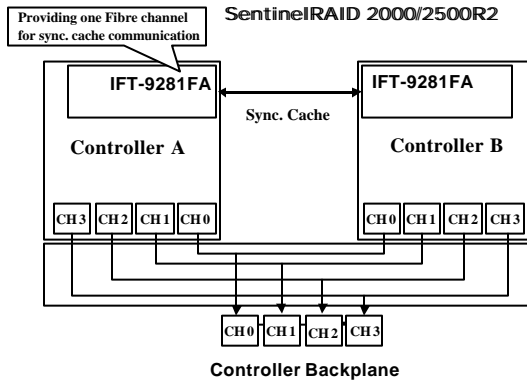
Serial Port:

Use the included serial cable, IFT-9512, to connect to J2. This is the only serial port connector because only the primary controller in this configuration responds to user's configuration and displays system events. If one controller should fail, the other will assume the role of the primary and gain access to all signal paths.

5.2 SentinelRAID 2000/2500R2:

All signals are connected between controllers through the system backplane. A Fibre channel (provided by the IFT-9281FA daughterboard: one Fibre processor) is appended as the dedicated communications path. This design avails all the SCSI channels for host or drive interfacing.

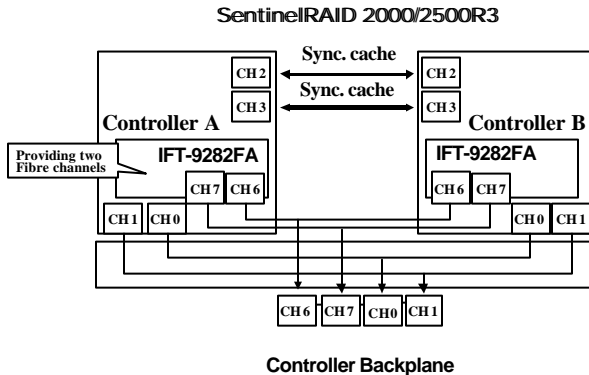
By default, channel 0 and channel 1 are the host channels. The functions of other interfaces are identical to those on the half-height controllers.



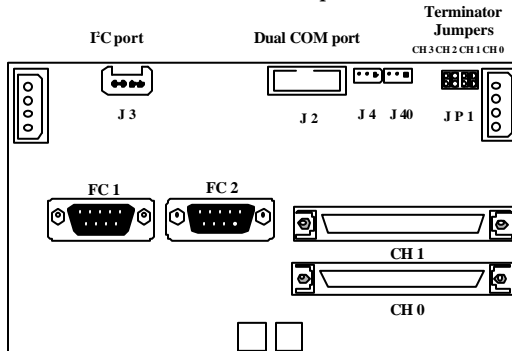
The relative locations of interfaces on IFT-9288BH are identical to those on IFT-9288BC.

5.3 SentinelRAID 2000/2500R3:

The solution is designed for Fibre-to-SCSI RAID operation. Channels 2 and 3 of the four SCSI channels serve as the communications paths for protection to cached data. SCSI channels 0 and 1 should be used for connecting drives. The IFT-9282FA Fibre daughterboard adds two Fibre channels (channels 6 and 7) as host interfaces. To guarantee Fibre loop integrity, port bypass circuits are implemented with controller backplane. The solution supports F_Port and FL_Port fabric logins with dual loop configuration allowing transfer rate up to 200MB/sec (1GHz Fibre).



Controller Backplane, IFT-9288BD:



Backplane Interfaces:

Other Interfaces have identical functions as those on the "R1" and "R2" configurations.

5.4 Redundant Controller Operation:

Active-active Configuration:

In active-active redundant controller mode, two controllers are connected to the same host(s) via host channel(s), to the same drives via their drive channels, and to each other through signal paths on the system backplane. The two controllers can be configured to concurrently process I/O requests from the host computer(s) and are continuously synchronizing cached data in each other's memory. The controller configuration data is constantly synchronized between the controllers so that the original configuration can be restored as soon as a failed controller is replaced.

5.4.1. Hardware Requirements:

The requirements for Redundant Controller Configuration are listed below:

- Both controllers must have the same cache memory size.
- Both controllers must be exactly the same running identical version of firmware.
- In redundant mode, the maximum number of disk drives on a drive channel is 14 and the maximum SCSI ID for disk drives is 15.
- On-board terminator circuits are provided. Follow the details in the introductory section to properly shunt the terminator jumpers.
- Host adapter port names are necessary for using the LUN Filtering function (firmware release 3.12 and above). Usually the port names can be found printed on the adapter card. You may also reboot the host computer to enter BIOS screen to find the number. Newer firmware releases (3.14 and above) can auto-detect the port names of devices connected over host channels.
- Write-back caching can improve processing speed. In order to protect cached data, it is recommended to apply battery

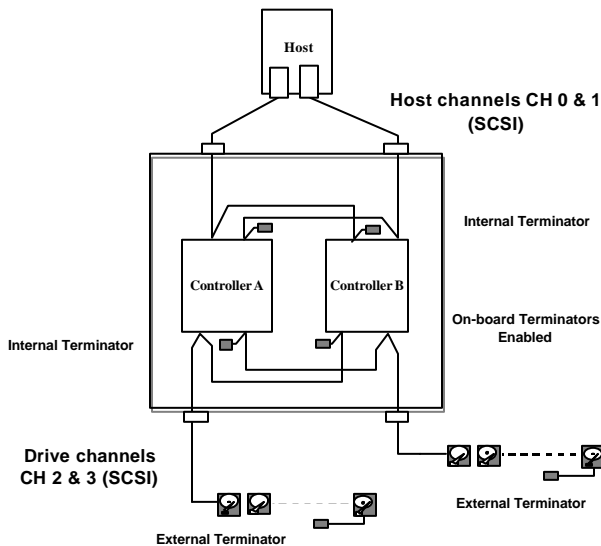
modules for each controller. Each of the controllers in the "R" series requires an independent battery module. If not using battery modules, it is recommended to switch controller caching mode to write-through.

- The SentinelRAID 2000/2500 "R" series uses drive-side SCSI IDs 8 and 9; thus, they are unavailable for drive use. The "R" series is pre-configured with primary and secondary IDs on all channels before shipping. Default values are recommended.

5.4.2. Basic Understanding

In the configuration diagramed below, host computer is connected to channel 0 and channel 1 on both controllers. This configuration brings a greater throughput via dual data paths and the redundancy allowing one path to fail. Host software support is required for directing I/O traffic to an existing connection should one HBA or host channel connection fail.

The following discussion is based on the R2 configuration. By default, channels 0 and 1 are host channels; channels 2 and 3 drive channels.



Active-active redundant controller operation:

For the optimum performance and making full use of all system resources, active-active controller configuration is the default for the R2 and R3 configurations.

Listed below are steps necessary for configuring an active-active system. Operation details will be discussed in the *Generic Operation Manual*:

1. Avail primary and secondary IDs on host channels. Defaults are recommended.
2. Avail primary and secondary IDs on drive channels. Defaults are recommended.
3. Create logical drives/volumes from physical drives and assign logical configuration of drives to different controllers.
4. Map logical drives/volumes to the primary or secondary ID/LUN combinations on different host channels.

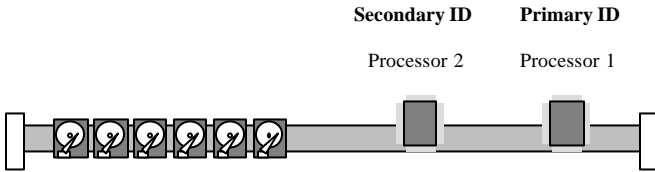
NOTE:

- *Although channel settings can be altered at will, it is not recommended to change the default settings on channel mode or ID settings. The default configurations have been adjusted for the balance between system performance and internal bus bandwidth.*
 - *Pass-through connections are made between controllers with all signal paths. This means that all functions, including event messaging, will be passed over to the existing controller automatically. No user's intervention is required after failover or fallback.*
-
-

Active/Standby Processors:

Processors on a drive channel: Host and drive channels are connected to both controllers. A drive channel starts from the connection to one controller, passes through the other controller, and then to drives. A drive channel thus constitutes a SCSI bus that has two SCSI channel processors. For the controllers to work redundantly over this channel, each of the processors should occupy either an **active ID** or a **spare ID**. Processor assigned with an active ID will handle the I/O activities on the SCSI bus. Processor assigned with a spare ID remains inactive until

the controller on which the active ID resides stops working. In this way, there is always an active ID (active processor) on a SCSI channel.



Drive Channel SCSI Bus

For a RAID system, the host computer can be considered as the initiator and drives as the targets on a data bus. The remaining issue would be how the I/O requests for data can be directed through what specific controller to drives. The first step is to define controllers as either the primary or the secondary controller. Once controllers are powered on, controllers will start to negotiate and resolve the primary-secondary relationship between them. As a result, multiple SCSI IDs (designated as primary/secondary IDs) on host and drive channels can be used to distinguish processors on the shared SCSI buses.

Primary/Secondary IDs: The situation within a redundant controller system is somewhat more complicated than taking host as initiator and drives as targets. I/O requests are received by the RAID controllers, processed, and distributed to chips on drive channels. Chips on drive channels then act as initiators. Commands are forwarded as drive commands. In practice, multiple drives can be grouped into RAID units; and, on the host side, these units can be mapped to either the primary ID or the secondary ID.

Host LUN Mapping: The primary-secondary assignment is not directly related to the active-standby status. It is Host LUN Mapping that determines which processor (controller) is active and which is a standby on each host or drive channel. Once a primary ID/LUN is assigned and mapped with a group of drives, the processor (the controller) designated by the primary ID on a host channel will become active. On the other hand, the processor designated with a primary ID on a drive channel (where the group of drives is connected) also becomes active.

Logical group of drives "mapped" to the primary ID/LUN on host channel will be managed by the processors on the controller designated as primary controller and vice versa. The secondary ID processor on the same bus will then be held inactive to serve as a substitute for the alternate processor.

In this way, by mapping groups of drives to the primary or secondary IDs, workload can be shared between controllers. In the event when one controller fails, the other will take over and inherit the LUN mapping from the failed controller to continue data processing.

Example:

Host ID setting: default in R2

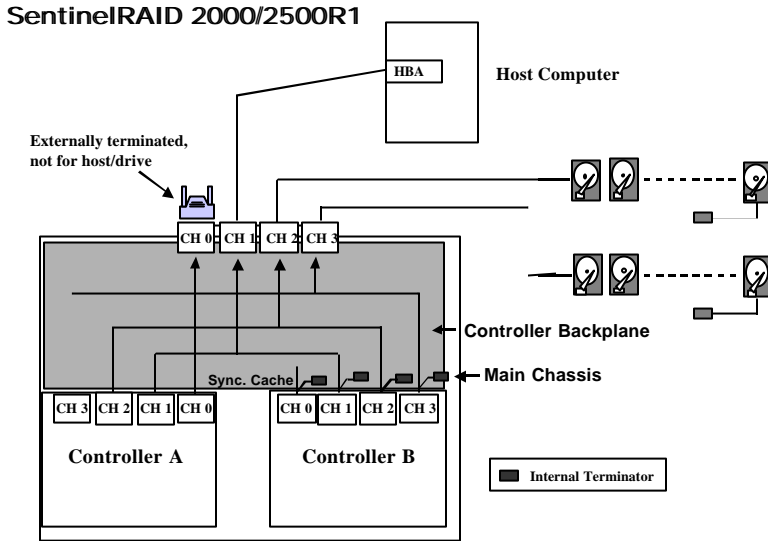
Host Channel	Primary ID	Secondary ID
channel 0	0	N/A
channel 1	N/A	0

A host channel connects to both controllers in an active-active redundant configuration. There can be one active and one standby processor on each host channel bus. In a dual-ported host configuration, each controller provides an active processor on one of the host channels and provides a standby processor to serve as a substitute for the one that is active on the alternate controller. If one of the controllers should fail, the surviving controller will assume all the ID mappings to continue I/Os.

Primary and secondary IDs can co-exist on the same host channel and each is mapped with logical configurations of drives. However, channel bandwidth becomes an issue while the host accesses two logical configurations through the same data path.

Dividing workload: Multiple logical units (logical drives/logical volumes) can be created from physical drives and assigned to either the primary or the secondary controller. Mapping logical units to IDs on different host channels can also distribute I/O traffic over different data paths.

5.4.3. Configuration Example: SentinelRAID 2000/2500 R1



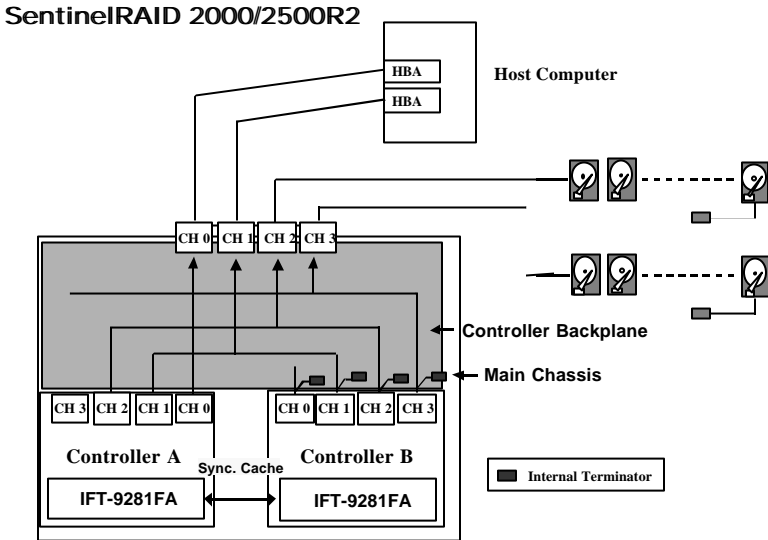
Host channel ID status: default

Host Channel	Primary ID	Secondary ID
SCSI channel 1	ID 0	N/A

Channel 1 is the default as host interface in the R1 configuration. Should a host adapter or host channel cable fail, data access to the host is discontinued.

The configuration can sustain failure of single controller and support active-standby operation. By default, logical configurations of drives should be assigned to the primary controller. The secondary controller will stay inactive and serve as a substitute in the event of controller failure.

5.4.4. Configuration Example: SentinelRAID 2000/2500 R2



Host channel ID status: default

Host Channel	Primary ID	Secondary ID
SCSI channel 0	ID 0 (active)	N/A
SCSI channel 1	N/A	ID 1 (active)

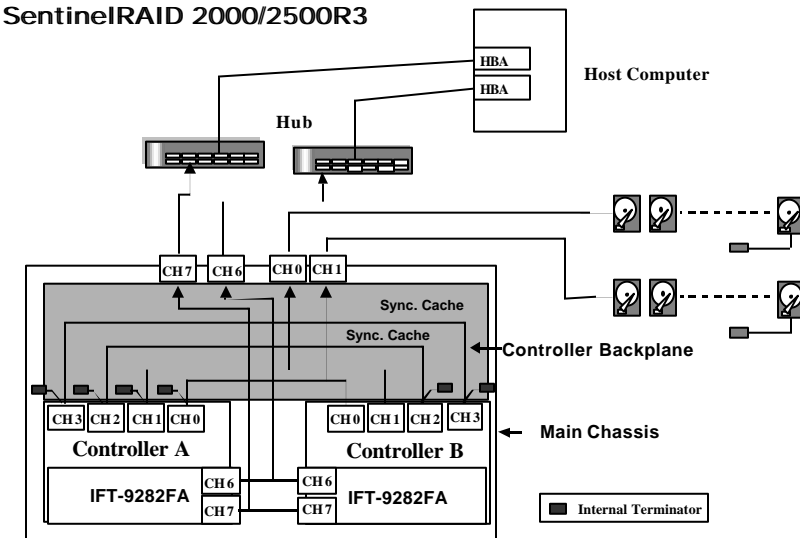
Applying multiple HBAs on host computer can isolate host channel I/O traffic and provide data path redundancy. Every SCSI bus is connected to the same channel on both controllers via system backplane. For every SCSI channel (chip) that is active, there is another on the alternate controller that stays inactive. Host software support is necessary for directing I/O traffic to an existing connection should one data path fail.

The configuration supports active-active operation mode. Separate logical configurations of drives can be assigned to different controllers and thus allowing workload to be divided and distributed across data paths.

Controller failure or failback is transparent to host without disrupting ongoing I/Os. No configuration is necessary upon the failure or when the failed controller is replaced by a healthy one.

5.4.5. Configuration Example: SentinelRAID 2000/2500 R3

The figure below depicts a single host with dual FC channels connected to an R3 configuration. With the proper host driver support, the two Fibre host channels can be configured in a dual-loop for data path redundancy and optimum throughput. In addition to the arbitrated loop configuration, the configuration also supports switched fabric connection through the use of MIA optical converters.



Default settings for all channels

Channel	Channel Mode	Primary ID	Secondary ID
Channel 0	Drive	8	9
Channel 1	Drive	8	9
Channel 2 (C)	RCCOM	/	/
Channel 3 (C)	RCCOM	/	/
Channel 6	Host	112	NA
Channel 7	Host	NA	113

Host LUN mapping determines the distribution of I/O traffic from host IDs. Host IDs can be assigned either to the primary or to the secondary controller and thus divide workload. Presuming that controller A is the primary controller, logical drives/volumes mapped to ID 112 on channel 6 will be managed by controller A and those mapped to ID 113 on channel 7 will be managed by controller B.

Controller failure or failback is transparent to the host. Should one of the controllers fail, the other will serve the I/Os originally destined to the failed one. The once "standby" connection will become the "active" I/O path served by the existing controller.

Supported Fibre Topologies:

- Point-to-Point Topology: direct server-to-storage connection.
- FC-AL, Private Loop Topology: a Fibre Hub is required for each loop; multiple servers can share storage.
- Fabric, Public Loop Topology: connected to a Fibre hub hanging off switch.
- Dual Loop Topology: Dual-loop load balancing is supported. Host software support is necessary for host-side dual-loop configuration.
- SAN environment (Storage Area Network) support: LUN filtering (RAID-based mapping). Also supports fabric log-on, F_Port and FL_Port switch attachment.

5.5 Replacement Controller:

SentinelRAID 2000R2-R	Main board + 9281FA
SentinelRAID 2000R3-R	Main board + 9282FA
SentinelRAID 2500R2-R	Main board + 9281FA
SentinelRAID 2500R3-R	Main board + 9282FA

Replacement controllers are provided as the adequate combinations of main circuit boards and daughterboards. Replace a failed unit in the R1 configuration with an ordinary 4-channel SentinelRAID main board.

Necessary Steps for Replacing a Failed Controller:

The following steps should be performed to restore a redundant system in the event of controller failure.

Firmware:

There are two different cases: Case 1 is a dual-redundant system running firmware before revision 3.21. Case 2 is a system running firmware revision 3.21 and above.

Step 1 Firmware Consistency & Pre-install Configuration

Case 1: A replacement controller may be installed with newer release of firmware. This causes compatibility problems since redundant controllers must operate with identical firmware. Before replacing the failed controller, ensure that a replacement is downgraded to be running the same version of firmware as the surviving controller. Downgrading firmware is the safest way to ensure compatibility.

Case 2: Firmware release 3.21 and above supports automatic firmware synchronization upon the insertion of a replacement controller. A replacement can be installed with a different firmware version.

Step 2 Auto-failback

Infotrend's PowerPC series controllers support auto-failback. Upon the insertion of a replacement, the surviving controller automatically

negotiates with the replacement and returns the original configuration of the failed controller to it. The replacement resumes the I/Os originally directed to the failed controller and all the configuration preferences.

1. Make sure the replacement controller is pre-configured as a "Secondary controller." In addition, the replacements must have the same amount of cache memory as the controller it is replacing.

```

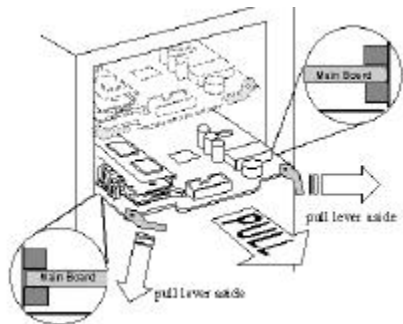
< Main Menu >
quick installation
view and edit logical drives
view Redundant Controller - Disabled
view P
view P enable redundant controller function in Autoconfigure mode
view T enable redundant controller function as Primary
view U enable redundant controller function as Secondary
view U
s
u
v
Set Peripheral Device Entry
Define Peripheral Device Active Signal
Adjust LCD Contrast
Voltage and Temperature Configuration
  
```

2. Remove the failed controller and install the replacement. The original system configurations will be automatically restored between the two controllers.

Removing and Installing Controllers

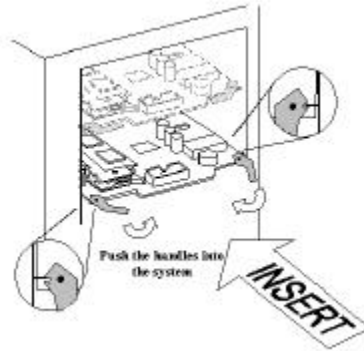
To remove a controller main board from the SentinelRAID "R" series to replace the failed controller, do the following:

1. To prevent damage to components caused by ESD, it is recommended that an anti-static wristband be worn.
2. Use the included bezel key (IFT-9531) to remove the front panel. Pull the "eject levers," located in the front of the controller on both sides, to the side. Make sure to pull each lever outwards as far as it will go.
3. Disconnect ribbon cable from the front panel and you may now pull out the controller's main board.



To install a controller board in the main chassis, do the following:

- 1.** To prevent damage caused by ESD to components, it is recommended that an anti-static wristband be worn.
- 2.** Gently slide the main board into the main chassis. Make sure the controller main board reaches the end of the chassis and is inserted properly into the metal grooves on each side of the chassis.
- 3.** Push the eject levers toward the center, moving them inward as shown above. Also make sure the square-shaped notches on the eject levers lock onto the edge of the metal groove.
- 4.** Connect the LCD ribbon cable between the main board and the front panel module.
- 5.** Install the front panel module back to its original position by pushing it gently into the front opening of the controller chassis.
- 6.** Once a replacement is inserted, controller-controller negotiation will begin and the existing controller will return the original configurations of the failed controller to the replacement.



Chapter 6 System Information

The working condition of a RAID controller may easily be affected by different factors: overheating, unstable voltage, component failure, etc. In addition to the overall environmental conditions within system enclosure, the controller can self-monitor different aspects of its working condition and automatically issue warning messages once an error occurs.

There are different ways to alert a system administrator of critical conditions: on-board alarm, LCD alert display, alert messages through terminal emulation; and, if the RAIDWatch manager is installed, a notification message can be sent remotely via E-mail, pager, fax, or broadcasting over LAN. In this chapter, the discussion on system environmental monitoring will focus on the access to this controller-embedded function through LCD display and terminal emulation. For more information on the manager, please refer to RAIDWatch manager's user manual.

The monitoring of remote devices within the RAID enclosure (cooling fans rotation speed, power supply status, temperature status, etc.) is dependent on the enclosure manufacturer's implementation. Please refer to the documents that came with your enclosure.

6.1 How to View System Environmental Information

6.1.1 Via LCD Push-button Panel

View Peripheral Device Status:

If the controller is properly installed, controller LCD should display the following message:

```
SR2500 v.3.* *  
Ready
```

The on-screen message should contain controller model number, firmware version, and status of RAID configuration. “Ready” means there is at least one logical drive or any RAID configuration unit mapped to host LUN’s. Before system configuration, LCD will display “No host LUN.”

Press **[ENT]** for two seconds to enter the main menu:

Press **▼** or **▲** to select "View and Edit Peripheral Dev," then press **[ENT]**.

```
View and Edit  
Peripheral Dev  ↓
```

Press **▼** or **▲** to select "Ctrl Peripheral Device Config.," then press **[ENT]**.

```
Ctrl Peripheral  
Device Config..
```

Press **▼** or **▲** to choose “View Ctrl Periph Device Status...”

```
View Ctrl Periph  
Device Status..
```

Press **▼** or **▲** to select the following options:

```
Voltage Monitor  
..
```

```
Temperature  
Monitor ..
```

```
Cooling FAN  
Monitor ..
```

Select either one of them by pressing **[ENT]**. For instance, choose “Voltage Monitor” and browse through different voltage statuses:

```
[+3.3v] 3.384V
Operation Normal
```

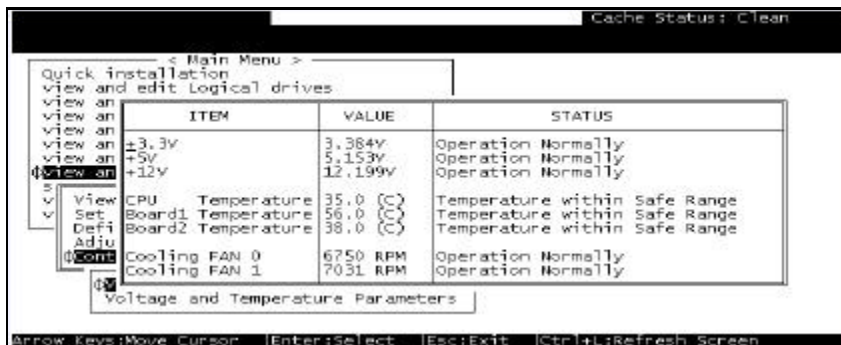
```
[+5v] 5.153V
Operation Normal
```

```
[+12V] 12.199V
Operation Normal
```

Follow the same method to browse through the statuses. The Fan status refers to the two cooling fans installed on the front panel module.

6.1.2 Via Terminal Emulation

Open your PC Terminal Emulation screen. Enter the main menu and select “View and Edit Peripheral Devices.” Use the arrow keys to scroll down and select “Controller Peripheral Device Configuration,” “View Peripheral Device Status,” and then press **[ENTER]**.



The controller operation status will be displayed.

6.2 How to Configure Threshold Parameters for System Environmental Monitoring

6.2.1 Via LCD Push-button Panel

Changing controller's threshold parameters for system error events can help different users to modify the tolerance range of the controller's self-monitoring function. Although the upper and lower thresholds can be modified, yet there is a safety limit embedded in firmware on both thresholds. If a value exceeding the safety range is entered, an error message will prompt and the new parameter will be ignored. Under specific circumstances, for example, the controller operates in a system enclosure where the upper limit on ambient temperature is relatively higher or lower, adjusting the default threshold parameters on controller board temperature can coordinate the controller status monitoring with that of the system.

To increase or decrease the upper and lower thresholds, follow the steps as described below:

Temperature and Voltage Parameters:

Press **[ENT]** for two seconds to enter the main menu. Press **▼** or **▲** to select "View and Edit Peripheral Dev \updownarrow ," then press **[ENT]** to confirm.

View and Edit
Peripheral Dev \updownarrow

Press **▼** or **▲** to select "Ctrl Peripheral Device Config..," then press **[ENT]** to confirm.

Ctrl Peripheral
Device Config..

Press **▼** or **▲** to select "Temperature and Voltage Parm..," press **[ENT]** to proceed.

Temperature and
Voltage Parm ..

Here we use the configuration of board temperature thresholds as an example. Press **▼** or **▲** to select "Trigger Threshold Board Temp Event," then press **[ENT]**.

Trigger Threshold
Board Temp Event

Press ▼ or ▲ to select the upper or lower threshold.

Upper Board Tem
Event-Def (80C)

Lower Board Tem
Event-Def (0C)

Press [ENT] to start configuration. Use ▼ or ▲ to enter any value within the safety range and press [ENT] to shift to next number, press [ENT] for two seconds to confirm. Any value beyond the safety range will be rejected by controller firmware.

Range 0°C-20°C
Input: □

Follow the same method to modify other temperature or voltage parameters.

6.2.2 Via Terminal Emulation

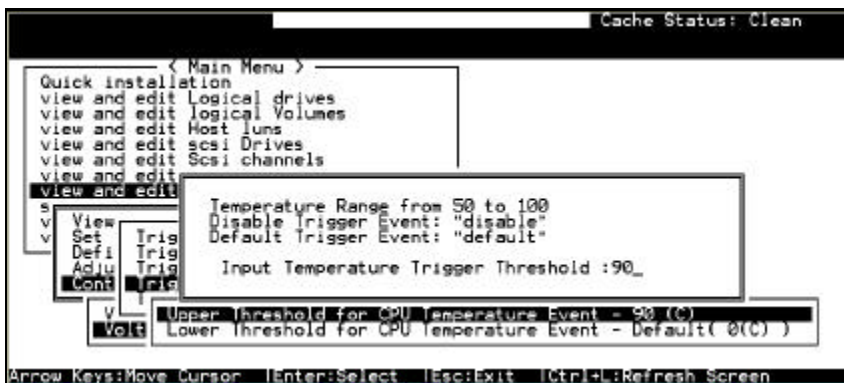
Open your PC Terminal Emulation screen. Enter the main menu and select “View and edit Peripheral devices.” Use the arrow keys to scroll down and select “Controller Peripheral Device Configuration,” “Voltage and Temperature Parameters,” and confirm by pressing [ENTER].



Scroll down and select an item to configure.



Select an item, for instance, “Trigger Thresholds for CPU Temperature Events.” Press **[ENTER]** and a list of selections will appear. You can choose to change the upper or lower threshold values. Press **[ENTER]** to confirm.



A configuration window will prompt. Enter any value within the safety range. Value exceeding the safety range will be rejected by controller firmware.



Follow the same method to modify other threshold parameters.

6.3 Adjusting LCD Contrast

The controller LCD contrast has been configured in an acceptable range before shipping. To modify LCD contrast:

6.3.1 Via LCD front panel:

From the main menu, select “View and Edit Peripheral Dev↓.” Press ▼ or ▲ to select “Adjust LCD Contrast..” press **[ENT]** to proceed.

Press ▼ or ▲ to adjust LCD display contrast. Press **[ESC]** to confirm.

```
View and Edit  
Peripheral Dev↓
```

```
Adjust LCD  
Contrast ..
```

```
LCD Contrast :  
■■■■■|-----
```

6.3.2 Via terminal emulation:



Select “View and Edit Peripheral Devices” from the main menu, press **[ENTER]** to confirm. Select “Adjust LCD Contrast,” and then press **[ENTER]**.

When prompted by the status bar, use arrow keys to adjust LCD display contrast. Press **[ESC]** key to confirm.



6.4 System Functions

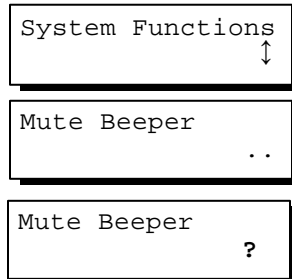
Mute Beeper

When the controller’s beeper has been activated, choose “Mute beeper,” then press **[ENTER]**. Choose “Yes” and press **[ENTER]** in the next dialog box to turn the beeper off temporarily. The beeper will still be activated on the next event.

6.4.1 Via LCD front panel:

From the main menu, select “System Functions↓.” Press **▼** or **▲** to select “Mute Beeper...,” press **[ENT]** to proceed.

Press **[ENT]** to confirm.

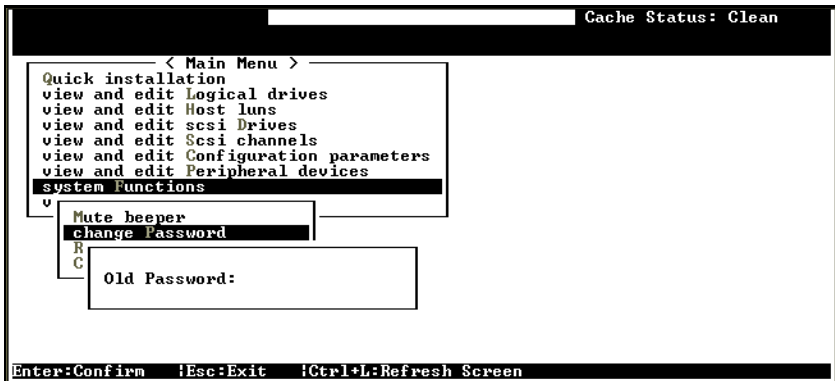


6.4.2 Via terminal emulation:



Select “System Functions” from the main menu, press **[ENTER]** to confirm. Select “Mute Beeper,” and then press **[ENTER]**. Choose yes to confirm.

Change Password



Use the controller’s password to protect the controller from unauthorized entry. Once the controller’s password has been set, regardless of whether the front panel, the RS-232C terminal interface or the GUI RAID Manager is used, the user can only configure and monitor the RAID controller by providing the correct password.

IMPORTANT!

- *The controller will verify the password only when entering the Main Menu from the initial screen or making configuration change. Always go back to the initial screen when the controller is going to be left unattended.*
 - *The controller password and controller name are sharing a 16-character space. The maximum characters for the controller password is 15. When the controller name occupied 15 characters, there is only one character left for the controller password and vice versa.*
-

Changing the Password

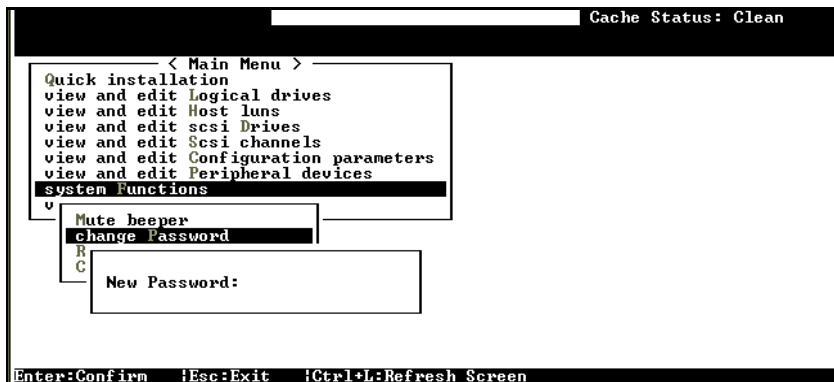
To set or change the controller password, move the cursor bar to “Change Password,” then press **[ENTER]**.

If a password has previously been set, the controller will ask for the old password first. If the password has not yet been set, the controller will directly ask for the new password. The password can not be replaced unless a correct old password is provided.

Key-in the old password, then press **[ENTER]**. If the password is incorrect, it will not allow you to change the password. Instead, it will display the message “Password incorrect!,” then go back to the previous menu.

If the password is incorrect, or there is no preset password, it will ask for the new password.

Setting a New Password



Enter the desired password in the column, then press **[ENTER]**. The next dialog box will display “Re-Enter Password.” Enter the password again to confirm and press **[ENTER]**.

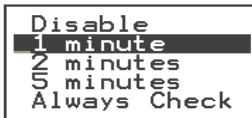
The new password will now become the controller’s password. Providing the correct password is necessary when entering the Main Menu from the Initial screen.

Disabling the Password

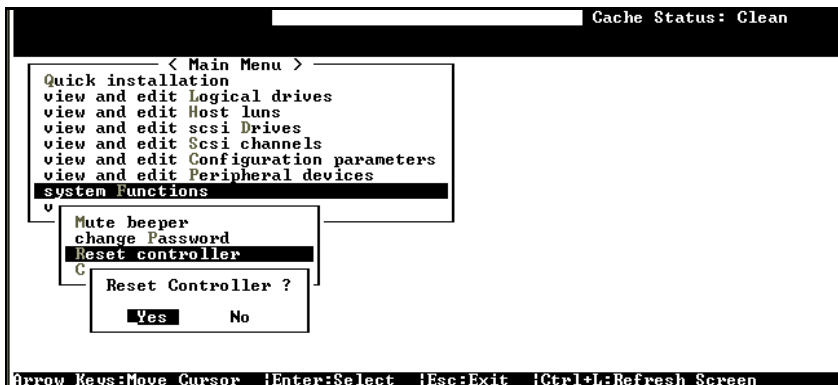
To disable or delete the password, press **[ENTER]** only in the password column that is used for entering a new password. The existing password will be deleted. No password checking will occur when entering the Main Menu from the initial screen.

Setting the Password Validation Timeout

The time interval setting can be found in the “system function” submenu. Set checking time interval to ”Always check” if the controller is to be left unattended for a long time. Any configuration change will be inaccessible without re-entering password. If the configuration screen is going to be left unattended for a period of time, settings from 1 minute to 5 minutes are also available.



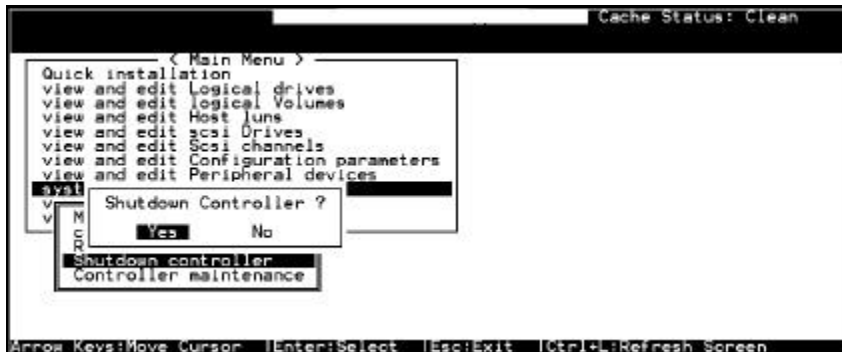
Reset Controller



To reset the controller without powering off the system, move the cursor bar to “Reset Controller”, then press **[ENTER]**. Choose **Yes** in the dialog box that followed, then press **[ENTER]**. The controller will now reset as well as power-off or re-power-on.

Shutdown Controller

Before you shutdown a controller, there may be unwritten data in cache. Use this function to flush controller cache memory before shutting down the system.



For downloading firmware functions, please refer to Appendix C of your *Generic Operation Manual*.

Appendix A Hardware Specifications

Unless specified, features listed below apply to both SentinelRAID Ultra2 and SentinelRAID Ultra160 series.

A.1 Configuration

Specification	Feature
RAID levels	0, 1(0+1), 3, 5, 10, 30, 50, JBOD, and non-RAID disk spanning
Host O/S compatibility	Host O/S independent
SCSI channels	4 on base module for SentinelRAID 2000/2500 2 on base module for SentinelRAID 1000/1500 Up to 8 (with optional daughterboard)
Host interface	LVD Ultra2 or Ultra160 SCSI (base module) 1 GHz or 2 GHz FC-AL Fibre (optional daughterboard)
Host channels	all channels can be configured as host or drive channels
Drive interface	LVD Ultra2 or Ultra160 SCSI (base module)
Drive channels	Up to 5 or 7, with optional daughterboard
Maximum number of SCSI drives	Up to 105 (with 7 drive channels)
Cache memory size	At least 32MB, architecturally up to 1GB, SDRAM DIMM socket x1 with ECC support
Cache mode	Write-through or write-back
Logical drives	Up to 8
Partitions	Up to 8 per logical drive/logical volume, total of 64

Number of LUN's	Up to 32 per SCSI ID
Multiple SCSI ID's per host channel	Yes
Firmware on Flash memory	Yes
Drive hot swapping	Yes
Controller hot swapping	Yes, via two 160-pin docking connectors (in redundant controller mode)

A.2 Controller Architecture

Specification	Feature
CPU	PowerPC® 750 microprocessor
SCSI controllers	LSI 53C896 or 53C1010 SCSI controller
Fibre controllers	Qlogic ISP2200 Fibre controller (on optional daughterboard)
DIMM slot	one 168-pin DIMM module
PC-100 support	Yes
ASIC	Infortrend 64-bit chipset
Flash ROM	16Mbit (2 MB)
NVRAM	32KB
Hardware XOR	Yes
Channel termination	LVD active termination, configurable via backplane DIP switch
I/O channel bandwidth	Ultra2/Ultra160 Wide SCSI: up to 80 Mbytes/sec or 160Mbytes/sec Fibre: up to 100 Mbytes/sec, single loop

A.3 RAID Management

Specification	Feature
SNMP agent support	Yes, Windows NT 4/Windows 2000; Solaris 7 & 8 (SPARC, x86); AIX 4.3; or Red Hat Linux 6.1 (kernel v2.2.xx); Red Hat 7, SUSE 7, WIN95/98, Windows Me
Performance monitoring	Yes
Remote control and monitoring	Yes
Event broadcast/alert	Yes (via Java-based RAIDWatch manager and Event Monitor)
Hardware connection	In-band SCSI, In-band Fibre, or RS-232C
Failure indicator	Via alarm, LCD panel, RAIDWatch manager, or terminal emulation

A.4 Fault Tolerance

Specification	Feature
Drive S.M.A.R.T. support	Yes (with user-configurable detect only, clone and replace, and perpetual clone functions)
Battery back-up option	Yes
SAF-TE support	Yes
S.E.S. support	Yes
ISEMS (Infotrend Simple Enclosure Management Service) via I ² C interface	Yes
Automatic drive failure detection	Yes
Automatic rebuild on spare drives	Yes
Regenerate logical drive parity	Yes
Bad block reassignment	Yes
Automatic rebuild upon failed drive replacement	Yes
Concurrent rebuild on multiple drives in a RAID (0+1) logical drive	Yes
Salvage the 2 nd temporary failed drive in a RAID 1, 3 or 5 logical drive	Yes

Salvage the 1 st temporary failed drive in a RAID 0 logical drive	Yes
Variable stripe size	<ul style="list-style-type: none"> ▪ Optimization for sequential: 128KB ▪ Optimization for random: 32KB

A.5 Software

Specification	Feature
In-band Text RAID Manager	Yes (all major platforms)
RAIDWatch Manager	Yes (for any platform that supports Java 2.0 or for Java Applet running via web browser)
LAN/WAN support via SNMP	Yes

A.6 Controller Specifications

Specification	Feature		
Controller size (in frame)	10.39 x 5.74 x 1.60 (L x W x H) inches		
main board size (without backplane)	6.88 x 5.62 inches		
Main board height with daughterboard	1.19"		
CPU	PowerPC® 750 microprocessor		
Cache memory	At least 32MB, architecturally up to 1GB, SDRAM DIMM socket x1 with ECC support		
Firmware	Resides in 2MB Flash memory		
NVRAM	32KB		
Operating voltage	SentinelRAID 2000		
	Main board		
		Normal	Peak
	5V	3.4A	5A
	12V	0.2A	0.4A
	When charging battery:		
	12V	0.4A	1.2A
	Main board + 9284U2 (SCSI D/B)		
	5V	4.5A	6.4A
	12V	0.2A	0.4A
	Main board + 9284U2F		
	5V	5.5A	7.8A
	12V	0.2A	0.4A
	Main board + 9282F		
	5V	5.1A	7.4A
	12V	0.2A	0.4A

SentinelRAID 2500		
Main board		
	Normal	Peak
5V	4A	5.4A
12V	0.2A	0.4A
When charging battery:		
12V	0.4A	1.2A
Main board + 9284U3 (SCSI D/B)		
5V	5A	6.4A
12V	0.2A	0.4A
Main board + 9284U3F		
5V	5.5A	6.8A
12V	0.2A	0.4A
Main board + 9282F		
5V	5.1A	7.4A
12V	0.2A	0.4A
Operating temperature	4 to 44°C	
Operating ambient temperature within enclosure	<50°C	
Relative humidity	10 to 95%, non-condensing	
Operating altitude	Sea level to 10,000 ft	
MTBF	Greater than 500,000 hours	
Devices per channel	SCSI: up to 15 wide SCSI devices Fibre: up to 125 devices (optional daughterboard)	
Supported device types	Synchronous or asynchronous	
RAID levels supported	0, 1(0+1), 3, 5, 10, 30, 50, JBOD and non-RAID disk spanning	
SCSI connectors	68-pin high-density connectors (x 4) on base module	
SCSI cables	Up to 12 meters with low-voltage differential	

Serial port	20-pin box header for COM1 & COM2
LCD panel	Yes
LED and push-button interface	Yes
Board connectors	160-pin male docking connectors (x 2) on main board (I-PEX model number T80043-160T): connects main board to main board backplane, integrating SCSI/Fibre channels, redundant controller features, RS-232C COM-1 and COM-2, battery connector signal, on-board alarm, external LCD module, SAF-TE status inputs, I ² C port and drive failure indication interface

Appendix B Hardware Troubleshooting

<u>PROBLEM</u>	<u>CHECK</u>
LCD is off	<ol style="list-style-type: none"> 1. Check power connections of the board and LCD panel. 2. Requires minimum of 32 MB SDRAM DIMM installed.
7-segment LED flashes "F"	<ol style="list-style-type: none"> 1. DIMM module not installed yet. 2. Null board (pin plug) for battery charger connector not installed.
SCSI channel failure detected upon start-up (SCSI cables connected) Message on LCD: SCSI CHLs fail CHL=x, x, x	<ol style="list-style-type: none"> 1. Check ID numbers (must be unique for each device on the same SCSI channel). 2. Make sure that SCSI channels are properly terminated. 3. Check the voltage output of the power supply. 4. Connect both power connectors
Initialization failure	<ol style="list-style-type: none"> 1. Check ID numbers (must be unique for each device on the same SCSI channel). 2. Make sure terminators are properly installed.
Cannot detect SCSI drive	<ol style="list-style-type: none"> 1. Check drive power connections. 2. Check drive SCSI cable connections. 3. Check ID numbers (must be unique for each device on the same SCSI channel).

Host can not detect the controller	<ol style="list-style-type: none"> 1. Check host SCSI cable connections. 2. Check SCSI port to LUN assignment. 3. Check logical drive's mapping to LUN. 4. If there is no logical unit created, the controller must be set as a peripheral device.
Parity error detected	SDRAM DIMM should be replaced.
Logical drive failure detected during boot-up	Check proper installation or connection of the drives (use the "View and Edit SCSI drives" function to help locating the problem).
System is not stable after running for a period of time.	<ol style="list-style-type: none"> 1. SCSI cable length must be within the range of specifications. 2. Make sure terminators are properly installed. 3. Power supply voltage must be within specification. 4. Check the enclosure's inner temperature.
When using "Scan New SCSI Drive" and the desired ID is empty, an empty drive entry appears	Remove the empty drive entry
The RS-232C Terminal Interface does not work.	<ol style="list-style-type: none"> 1. Check RS-232C cable connections. 2. Check if the Baud Rate settings on both ends identical. 3. Enable Terminal Emulation. 4. Data Routing Direct to Port.
When choosing "Configure Modem Port", the screen is full of "Comm Buffer Overflow".	"Terminal Emulation" should be enabled after all modem configuration are completed.

<p>The logical drive states "INVALID".</p>	<ol style="list-style-type: none"> 1. "Optimization for ... I/O," when creating the logical drive in Cache Parameter, is different from the current setting. 2. Change "Optimization for ...I/O" to the opposite setting and reset the controller.
<p>In "View and Edit SCSI Drives" or "View and Edit SCSI Channels", the speed is only "80Mhz" (Ultra160 machines), not "160Mhz"</p>	<p>"80Mhz" is SCSI sync frequency, not transfer rate.</p>
<p>All settings are too complex to remember.</p>	<ol style="list-style-type: none"> 1. After the system installation is complete, write down all the settings and related information in Chapter 11 of your "Generic Operation Manual" for future reference. You may also save your configuration data as a retrievable file. 2. Save NVRAM to a file or to drives
<p>Upon replacing the failed controller with a new one during redundant controller connection, nothing appears on the LCD of the new controller.</p>	<ol style="list-style-type: none"> 1. Set the new controller as "redundant controller enabled" before connecting to the active controller. 2. Connect the new controller to the active controller and choose "Deassert failed controller" on the active controller. 3. Refer to "Chapter 12, Redundant Controller" for more details.
<p>Error: Check DRAM Installed?</p>	<p>Check to see if a DIMM module is installed or properly installed.</p>

<pre>SR2000 v3.** No Host LUN</pre>	<p>This is a normal message if no logical drive has been created or no logical drive has been mapped to a host channel ID/LUN.</p>
<pre>SR2000 v3.** Ready</pre>	<p>This is a normal message when a logical drive has been created and mapped to a host channel ID/LUN.</p>
<pre>[Other error messages]</pre>	<p>Please contact your dealer for assistance with any other error messages. You may also refer to Appendix D of your "Generic Operation Manual" to learn more about error messages.</p>

Appendix C SCSI/Fibre Cable Specifications

The recommended SCSI cable for an Ultra2 Wide SCSI operating at a transfer rate of 80 Mbytes/sec. is described below.

Electrical	
Impedance	120Ω ± 10%
Capacitance	15.9 pf / ft @ 1MHz
Propagation Delay	1.59ns / ft nom
DC Resistance	95Ω / 1000 ft @ 20°C
Delay Skew	0.035ns / ft (max.)

The recommended specifications for the 1GHz Fibre channels (daughterboard with Fibre channels) is described below:

Electrical	
Material	Copper
Maximum Length	30m between each device
Impedance	150Ω
Connector Type	AMP 3-position header, male, right-angle
Propagation Delay	1.59ns / ft nom
DC Resistance	95Ω / 1000 ft @ 20°C
Delay Skew	0.035ns / ft (max.)

SCSI Standards, Cable Length and Corresponding Maximum Possible Drive Connections

	Single-Ended	Differential	Ultra2	Fibre	Maximum Devices
SCSI-1	6 m	25 m	-	-	8
SCSI-2	3 m	25 m	-	-	8
Wide SCSI-2	3 m	25 m	-	-	16
Ultra SCSI-2	1.5 m	25 m	-	-	8

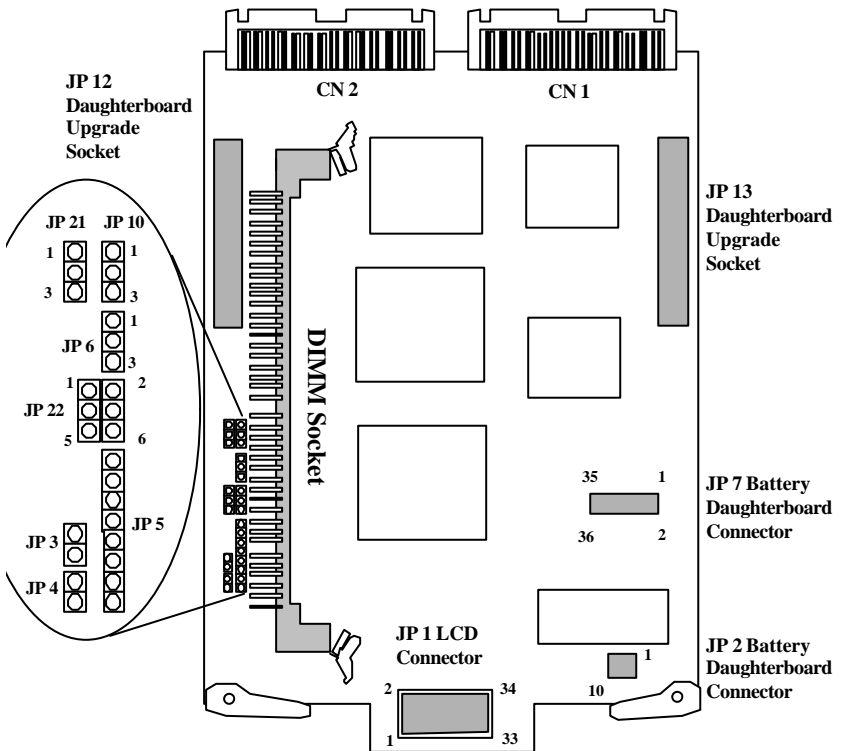
Ultra SCSI-2	3m	-	-	-	4
Ultra Wide SCSI-2	-	25 m	-	-	16
Ultra Wide SCSI-2	1.5 m	-	-	-	8
Ultra Wide SCSI-2	3 m	-	-	-	4
Ultra2 Wide SCSI	-	-	12 m	-	16
Ultra160 SCSI	-	-	12 m	-	16
Fibre (copper cable)	-	-	-	30m	126
Fibre (fiber-optic cable)	-	-	-	10km	126

SCSI Bus Width and Maximum Throughput

	Bus Width	SCSI Bus Sync. Frequency	Max. Bus Throughput
SCSI-1	8-bit	Asynchronous	5 MB/Sec
(Fast) SCSI-2	8-bit	10 MHz	10 MB/Sec
(Fast) Wide SCSI-2	16-bit	10 MHz	20 MB/Sec
Ultra SCSI-2	8-bit	20 MHz	20 MB/Sec
Ultra Wide SCSI-2	16-bit	20 MHz	40 MB/Sec
Ultra2 Wide SCSI	16-bit	40 MHz	80 MB/Sec
Ultra160	16-bit	80 MHz	160 MB/Sec
Fibre	1-bit	1 GHz	100 MB/Sec

Appendix D Connectors and Jumpers Identification

Controller Main Board Interfaces



Connector	Description
JP 1	LCD connector
JP 2	Battery daughterboard connector
JP 3	NMI - non mask interrupt (Enable: shorted)

JP 4	Reset (Enable: shorted)
JP 5	GAL, LATTICE, 2064 - for Program Download
JP 6	Loop back test (enable: 2-3 shorted, normal: 1-2 shorted)
JP 7	Battery daughterboard connector
JP 9	NMI - non mask interrupt (Enable: shorted)
JP 10	LCD type selection (4-line: 1-2 shorted; 2-line: 2-3 shorted)
JP 12	Daughterboard upgrade socket
JP 13	Daughterboard upgrade socket
JP 21	Front panel fan status detect (disable: 2-3 shorted)
JP 22	LED connector
CN1	Main board to backplane connector
CN2	Main board to backplane connector

JP 22 LED connector pinouts

Pin	Pin name	Pin	Pin name
1	Power	4	GND
2	GND	5	Atten
3	Busy	6	GND

JP1 LCD Pin Header (17 x 2) for 2-line LCD Module

JP1 LCD connector pinouts

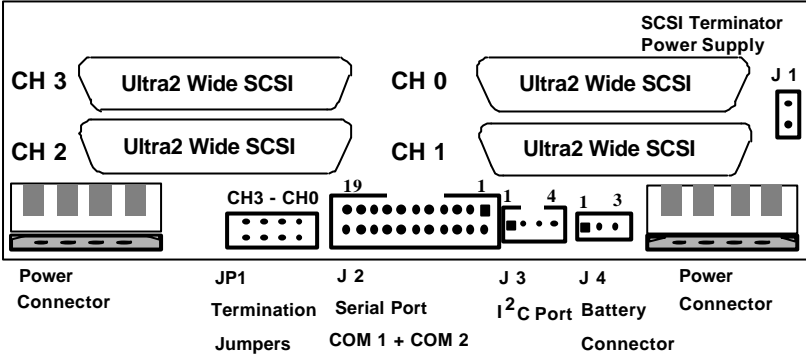
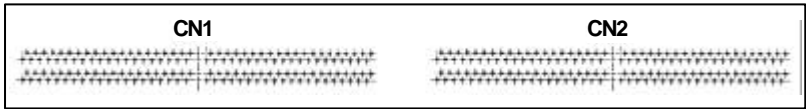
Pin	Pin Name	Pin	Pin Name
1	VCC	2	GND
3	LCDLVO	4	LCDDI-
5	LCDRW-	6	LCDEN
7	LCD0	8	LCD1
9	LCD2	10	LCD3
11	LCD4	12	LCD5
13	LCD6	14	LCD7
15	GND	16	N/C
17	N/C	18	UPPUSH
19	ESCPUSH	20	DOWNPUSH
21	ENTPUSH	22	BUSYLED
23	V12V	24	ATTENLED
25	POWERLED	26	N/C
27	FAN2	28	V12V
29	N/C	30	Fan1
31	GND	32	VCC
33	N/C	34	N/C

Connector Pin Name Descriptions:

Pinout Description

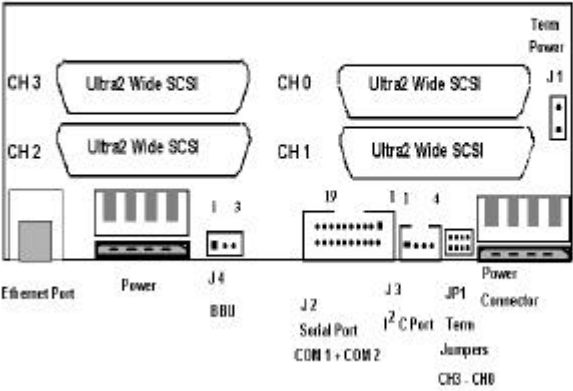
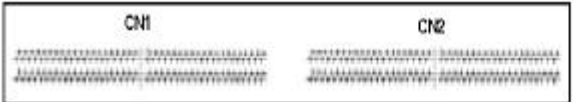
Symbol	Type	Description
LCD(0-7)	I/O	Common pins in "LCD" mode: 8 LCD data lines
LCDLVO	O	LCD contrast voltage
LCDRW-	O	LCD read/write
GND	G	Signal ground
POWERLED	O	Front panel LED:"POWER"
BUSYLED	O	Front panel LED:"BUSY"
ATTENLED	O	Front panel LED:"ATTEN"
ESCPUSH	I	Front panel <Escape> button
ENTPUSH	I	Front panel <Enter> button
UPPUSH	I	Front panel up-arrow button
DOWNPUSH	I	Front panel down-arrow button
VCC	P	+5V voltage input
Fan 1 & 2	I	Detect Fan RPM
LCDDI-	O	LCD read/write
LCDEN	O	LCD Enable
12V to 5V	P	+5V voltage input
V12V	P	+12V voltage input

N/C		No connection
-----	--	---------------



■ Pin 1 of connector

Controller Backplane Diagram



■ Pin 1 of connector

Controller Backplane Diagram

PCB version 1.3 and above - Compatible with Main board PCB version 2.7 and above

Serial Port: COM 1 and COM 2 (J 2)

Serial Port Pinouts

Pin	Pin name	Pin	Pin name
1	DCD1	11	DCD2
2	RSR1	12	DSR2
3	RXD1	13	RXD2
4	RTS1	14	RTS2
5	TXD1	15	TXD2
6	CTS1	16	CTS2
7	DTR1	17	DTR2
8	RI1	18	RI_RST
9	GND	19	GND
10	N/C	20	N/C

Serial Port Pin Descriptions:

Pinout Descriptions

Symbol	Type	Description
CTS1	I	Clear to send (COM1)
DCD1	I	Data carrier detect (COM1)
DSR1	I	Data set ready (COM1)
DTR1	O	Data terminal ready (COM1)
GND	G	Signal ground
N/C		No connection
RI1	I	Ring indicator for COM1
RTS1	O	Request to send (COM1)
RXD1	I	Receive data (COM1)
TXD1	O	Transmit data (COM1)
GND	G	Signal ground
CTS2	I	Clear to send (COM2)
DCD2	I	Data carrier detect (COM2)
DSR2	I	Data set ready (COM2)
DTR2	O	Data terminal ready (COM2)
RTS2	O	Request to send (COM2)
RXD2	I	Receive data (COM2)
TXD2	O	Transmit data (COM2)
RI_RST		Redundant Controller Reset (reserved)

I²C Port (JP-3)

I²C Port Pinouts

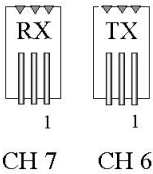
Pin	Pin name
1	I ² CCLK
2	GND
3	VCC
4	I ² CDATA

Ethernet Port

RJ-45 Pinouts

Pin	Pin name	Pin	Pin name
1	DCD1	11	DCD2
2	RSR1	12	DSR2
3	RXD1	13	RXD2
4	RTS1	14	RTS2
5	TXD1	15	TXD2
6	CTS1	16	CTS2

3-Pin Fibre



Pinouts

TX Pin	Pin name	RX Pin	Pin name
1	TXP	1	RXP
2	TXN	2	RXN
3	GND	3	GND

I²C Connector Pin Name Descriptions:

Pinout Description

Symbol	Type	Description
GND	G	Signal ground
I2CCLK	O	I ² C clock
I2CDATA	O	I ² C data
VCC	P	+5V voltage input

J 1 Terminator Power

This connector provides an auxiliary 5 V power to the SCSI terminator circuits on daughterboard backplane. In the situation when a controller is removed, power to the daughterboard backplane will be discontinued causing the SCSI buses to fail. In redundant mode, every I/O channels are connected to both controllers and power must be maintained with term circuits even when one of the controller is absent. To prevent bus failure, connect J 1 on controller backplane to J 1 on daughterboard backplane with the IFT-9515 linking cable.

Pin	Pin name
1	VCC
2	GND

Battery Connector (JP-4)

Battery Connector Pinout (JP-4)

Pin	Pin name
1	VBAT_P
2	VBAT_THM
3	VBAT_N

Battery Connector Description:

Battery Connector Pinout Description

Symbol	Type	Description
VBAT_N	I	Battery -
VBAT_P	I	Battery +
VBAT_THM	I	Battery thermal

IFT- 9011 Null Modem

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

IFT-9012 RS-232C Extension Cable

Extend the cable length only, no wire swap.

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