

EonRAID 2000

Fibre-to-Fibre RAID Controller

Hardware Manual

Revision: 1.4



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This Edition First Published 2000

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Revision History

| | |
|-----------------------------------|--|
| 2/20/00 version 1.0 | Initial release |
| 4/25/00 revision 1.1 | Added SCSI/Fibre Cable Specifications Added Connector and Jumper Identification and Pinouts Added System Information and Hardware parameters |
| 7/7/00 revision 1.2 photo copy | Added Chapter 5 "Dual Redundant Chassis" for EonRAID 2000R1 and EonRAID 2000R2 Added details for IFT-9535 "x" cable and IFT-9519 extension cable Added details of Fibre topologies |
| 7/7/00 revision 1.3: | Official printing |
| 10/25/00 revision 1.4: | Updated details about redundant controller configuration |

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About This Manual

This manual provides the necessary information a system administrator with experience in RAID technologies needs to install and upgrade the EonRAID 2000 RAID controller. For information on the configuration and use of the controller, please refer to the *Generic Operation Manual*.

The manual will be continuously updated to be compatible with the newest releases of product versions. This manual is fit for the operation with the EonRAID 2000 of the following hardware and firmware version:

PCB Version: 2.01 or above
PCBA Version: 1A or above
Firmware Version: 3.12 or above
Part No.: M5200UNH14
Date: 10/25/2000

- Chapter 1 Provides a quick installation guide, showing steps necessary for installing and configuring a RAID controller.
- Chapter 2 is a feature summary.
- Chapter 3 Illustrates in detail locations of the parts; general identification
- Chapter 4 Shows how to install/upgrade the controller hardware components.
- Chapter 5 Shows how to configure the dual redundant chassis EonRAID 2000R1 and EonRAID 2000R2.
- Chapter 6 Provides details on how to view and configure system information
- Appendix A Details the hardware and firmware specifications.
- Appendix B provides the answers for the difficulties you may encounter when installing this controller.
- Appendix C Provides cable lengths and number of devices allowed for various I/O interfaces, bus frequency, clock period, and transfer rates.
- Appendix D provides the general identification of jumpers and connectors. Pin assignments are also included.

Introduction

Thank you for purchasing the EonRAID 2000.

The EonRAID 2000 is a Fibre-to-Fibre RAID controller specifically designed to provide RAID 0, 1(0+1), 3, 5, or JBOD capability to any host system or storage network equipped with a Fibre interface. RAID levels 10, 30, and 50 are available by implementing logical volumes. The controller is completely independent of the host system's operating system. All RAID functions are performed by a PowerPC® RISC CPU with high-speed SDRAM 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 contiguous volume and for providing full-featured fault-tolerance in Storage Area Network.

The controller has comprehensive drive failure management that allows automatic reassignment of reserved blocks when a bad sector is encountered during a write. Disk hot-swap is supported through automatic disconnection of a failed drive and detection of a reserved drive, followed by background rebuilding of data. The controller also supports dedicated or global hot spare operation. What is remarkable is all these failure recovery procedures are transparent to the host system.

The controller has been designed with ease of integration and maintenance in mind. All major features are described in Chapter 2. 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.

There are four backplane designs for the EonRAID 2000 series. The IFT-9288B6A provides 4 Fibre for host/drive and 2 Ultra2 SCSI channels for synchronized cache communication. The IFT-9288B6B provides 6 Fibre channels and no SCSI port. Until the firmware support for controller communication over Fibre loops is ready, the 6 channel combination can not be used in redundant controller configuration. Phase II design of the 9288B6B will support controller communications over Fibre loops. The IFT-9288BF is designed for 5.25" full-height chassis with redundant 4 Fibre channels and built-in sync. cache channels. The IFT-9288BB is also an integrated backplane for 5.25" full-height chassis. It provides 6 redundant Fibre channels

and redundant controller configuration. All of them are vertical backplanes and also the back panels of controller chassis.

| Models | Fibre channels | Sync. cache channels |
|----------------|-----------------------|--|
| EonRAID 2000-4 | 4 | External Ultra2 connection |
| EonRAID 2000-6 | 6 | RCC over FC loop(s) - not supported until firmware release 3.14 and phase II backplane |
| EonRAID 2000R1 | Redundant 4 | Routed on controller backplane |
| EonRAID 2000R2 | Redundant 6 | Routed on controller backplane |

EonRAID 2000-4: The EonRAID 2000-4 provides 4 Fibre channels and 2 Ultra2 Wide LVDs. The SCSI channels should be used for a synchronized cache connection between two controllers in the redundant controller mode.

EonRAID 2000-6: The IFT-9282FA daughterboard adds another two channels. This model provides 6 Fibre channels without SCSI ports. The coming release of firmware will support controller communications through Fibre loops (dedicated or distributed to all). This function will also be implemented with the phase II design of controller backplane.

EonRAID 2000R1/R2: four or six redundant Fibre channels of two EonRAIDs are routed via a vertical controller backplane. Using two Ultra2 channels as the dedicated sync. cache path, cached data can be synchronized between the two redundant controllers. The 2000"R" also provides bypass circuits to guarantee loop integrity should one of the controllers fail.

Standard Package Contents (EonRAID 2000-4 & the "R" series)

- The EonRAID 2000 series RAID controller
- A CD title for Drivers and Utilities
- Generic Operation Manual
- This Hardware Manual
- IFT-9512 serial combo cable
- IFT-9531 bezel key
- IFT-9011 Null Modem
- IFT-9535 serial cable for redundant controllers (included with special order)

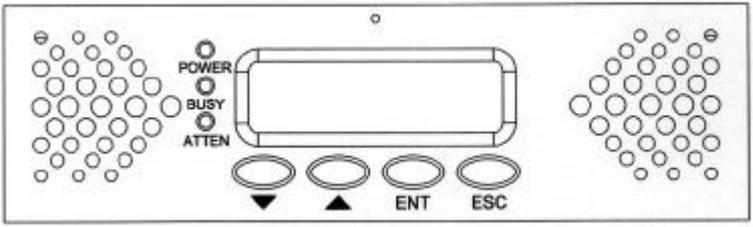
Standard Package Contents (EonRAID 2000-6)

Six-channel solution with 9288B6B phase II back panel.

- The EonRAID 2000 series RAID controller
- A CD title for Drivers and Utilities
- Generic Operation Manual
- This Hardware Manual
- IFT-9536 RCC communication cable x 2
- IFT-9512 serial combo cable
- IFT-9531 bezel key
- IFT-9011 Null Modem
- IFT-9535 serial cable for redundant controllers (included with special order)

Quick Installation

Front Panel (LCD) EonRAID 2000



Key:

[ESC] = Pressing the Escape key

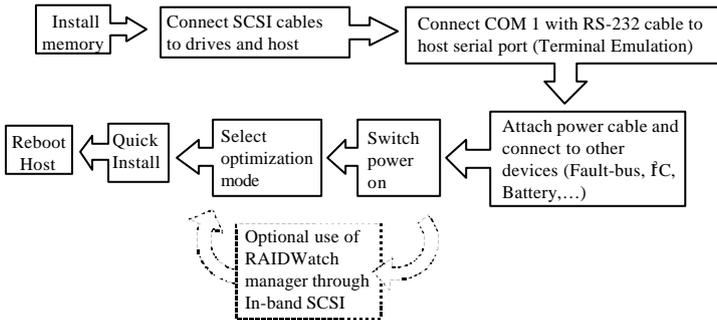
[ENT] = Pressing the Enter key

[▲] = 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

Hardware installation details will be discussed in the following chapters.

Optimization for Random or Sequential I/O

Before creating a logical unit, 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. Optimization for Sequential I/O will be a default when creating a logical drive with capacity larger than 512GB. Please also refer to Chapter 6 and Chapter 8 of your *Generic Operation Manual* for details.

After adding memory and power, the LCD should read, “ER2000 V3.11F NO HOST LUN.”

[**ENT**] for two seconds to “Quick Logical Drive Install ↓”

[**ENT**] to see “Set TDRV=8 with LG RAID5+Spare?” TDRV means the total number of drives.

Press [**▲**] or [**▼**] to select desired RAID level configuration, see the options below and also refer to *Generic Operation Manual*:

RAID 5 + Spare

RAID 5

RAID 3 + Spare

RAID 3

RAID 1 + Spare

RAID 1

RAID 0

NRAID

[**ENT**] to select an option, for example, “RAID5+Spare”

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. Upon completion, LCD will read “LG=0 Initialize Completed.” The logical drive will be automatically mapped to the first available host LUN.

[**ESC**] three times to main screen, “ER2000 v3.11F READY.”

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.

NOTE:

- 1. You may need to reboot your Host to “see” or negotiate with the controller. When Fibre 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. ER2000 is the abbreviation of EonRAID 2000. The LCD will display ER2000. For EonRAID 2000R1/R2, the abbreviations will be ER2000R1 or ER2000R2.*
 - 3. When the host computer resets, the Fibre interface adapter will issue a “LIP (loop initialization protocol)” to the loop. According to the LIP, controller will display a warning message, “CH_ Fibre Loop Failed,” which is normal during a host computer reset, powering on or disconnecting the Fibre cable.*
-
-

Feature Summary

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 | Logical volume with RAID 1 logical drives |
| RAID 30 | Logical volume with RAID 3 logical drives |
| RAID 50 | Logical volume with RAID 5 logical drives |

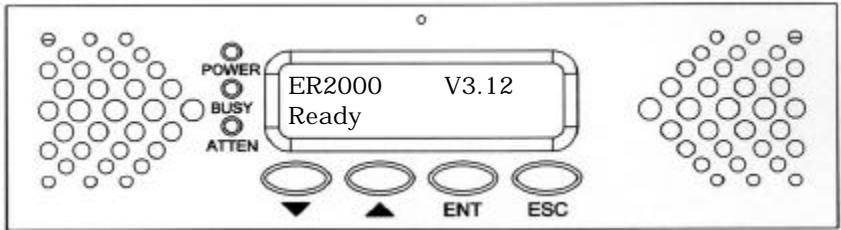
- ✓ Comprehensive failure management including:
 - Automatic bad block reassignment
 - Drive hot-swapping
 - Controller hot-swap capability (when redundant controller is enabled)
 - Spare drive operation (supports both Global Spare and Dedicated Spare)
 - Background rebuilding (Rebuild priority selectable)
 - 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
 - Supports logical drive expansion
- ✓ 5.25" industry standard drive profile allows easy integration into external subsystem enclosures or directly into the host system's drive bay
- ✓ Up to six drive channels (with optional 2-channel upgrade), a total of 125 connected devices per channel (Fibre operation)
- ✓ Supports up to 125 ID's per Fibre loop

- ✓ Optional upgrade daughterboards:
 - IFT-9282FA: 2 Fibre channels
- ✓ Controller Backplanes:
 - IFT-9288B6A: 4-channel solution
 - IFT-9288B6B: 6-channel solution
- ✓ Up to 8 logical drives, each with independent RAID modes; up to 32 LUN's per channel ID
- ✓ SAN support: LUN Filtering (RAID-based mapping or masking; auto-detect the WWN's of Fibre devices), drive-side redundant loop load balancing, Global file system (Dlocks)
- ✓ Up to 8 partitions per logical drive/logical volume
- ✓ Logical drive, logical volume, and the controller itself can be assigned a name for ease of identification
- ✓ Number of drives for each logical drive: 31 (RAID 5/RAID3); 45 (RAID0/NRAID); 44 (RAID1)
- ✓ 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 modes for either sequential or random I/O
- ✓ Allows multiple drive failure and concurrent multiple drive rebuild of a RAID (0+1) logical drive
- ✓ Prior to first disk access, it allows adjustment of delay time during controller initialization to enhance compatibility with slow-initial drives.
- ✓ All channels are FC-AL Fibre and can be configured as either a host or drive interface.
- ✓ Two or more Fibre channels can be simultaneously set as host interface for redundant host system operation
- ✓ Uses PowerPC® RISC CPU with all executable firmware downloaded into high-speed SDRAM
- ✓ SDRAM DIMM supports ECC function
- ✓ Up to 1GB of intelligent Read-ahead/Write-back cache
- ✓ Firmware resides in easy-to-update flash memory

- ✓ Write algorithm: Write-through, write-back, multi-threaded intelligent predictive read-ahead, optimized sorted grouped writes
- ✓ MIA supported on all Fibre channels to convert Fibre copper signal to Fibre optic signal for longer cable connection
- ✓ Host-side redundant loops supported (host computer software/drivers required)
- ✓ Drive-side redundant loops supported with intelligent loop balancing
- ✓ Controller self-monitoring features: monitors the voltages (+5/+12), temperatures (CPU, ASIC,...) and fan rpm status (front panel fans)
- ✓ Dual power connector design: prevents single point of failure on the power connector and also guarantees a more efficient power source
- ✓ Supports 168-pin PC-100 industry standard SDRAM module (Buffered, unbuffered, ECC, non-ECC)
- ✓ CPU level-2 high speed cache equipped to increase random I/O performance
- ✓ Infortrend unique dual-ASIC separate-bus architecture increases the sequential I/O performance
- ✓ Front panel LCD and push button keypad for host-independent configuration and message display
- ✓ Supports TELNET with PPP protocol for remote administration
- ✓ RAIDWatch manager and RS-232C terminal interface for RAID management
- ✓ S.E.S. support
- ✓ Supports ISEMS (Infortrend Simple Enclosure Management Service) via I²C interface for enclosure management
- ✓ In-band Text RAID Manager provided for configuration through 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

Hardware Introduction

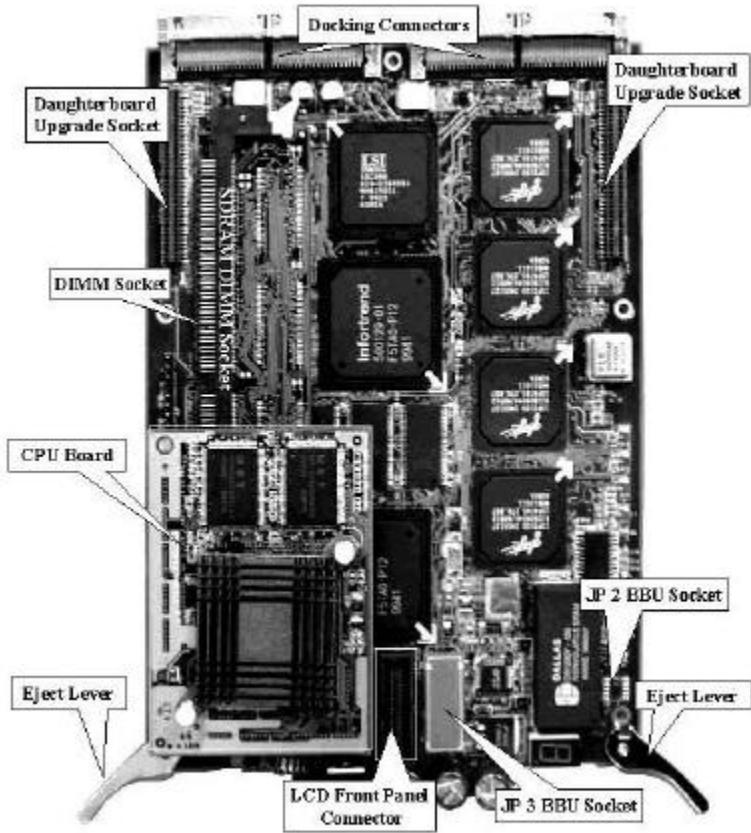
3.1 Locations of the Parts



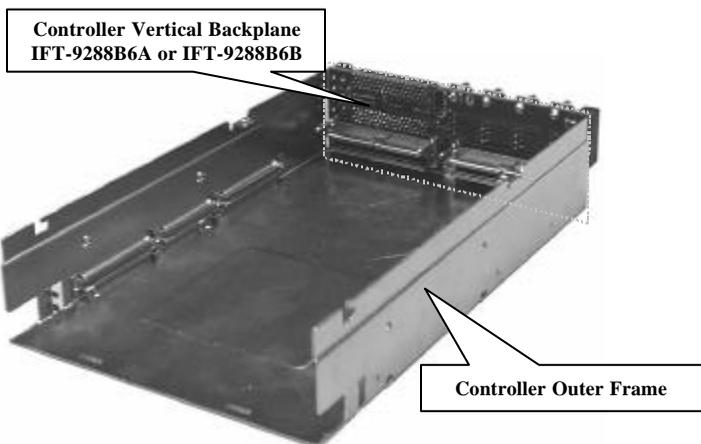
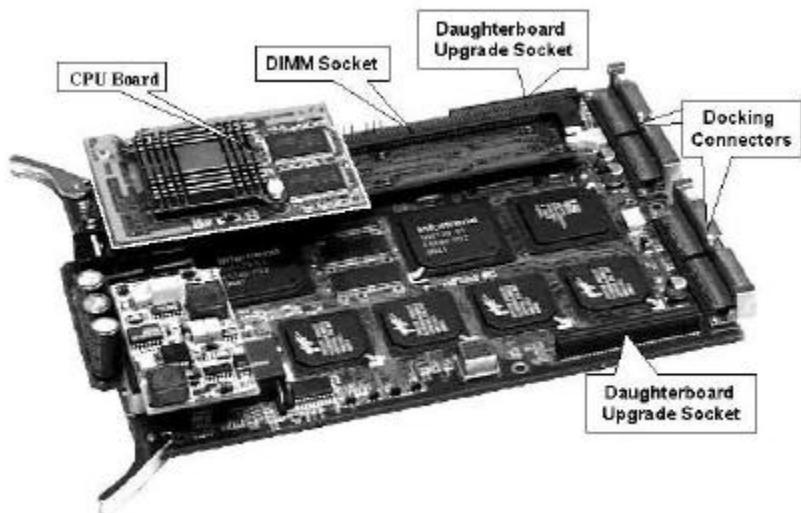
3.1.1 LCD Panel

| | |
|-------------|---|
| POWER | Lighted LED indicates that power is on. |
| BUSY | Unlit indicates no activity. Blinking indicates data is being accessed. Lighted LED indicates unprocessed cached data is still in the memory. |
| ATTEN | Lights when an error message appears or service is required, e.g., when a drive fails and needs to be replaced. |
| ▼ ▲ Buttons | Scroll through available options. |
| ENT button | Choose or execute an option. |
| ESC button | Return to previous menu or cancel the selection. |
| 2 x 16 LCD | Displays throughput during normal operation, Displays message for configuration and management. |

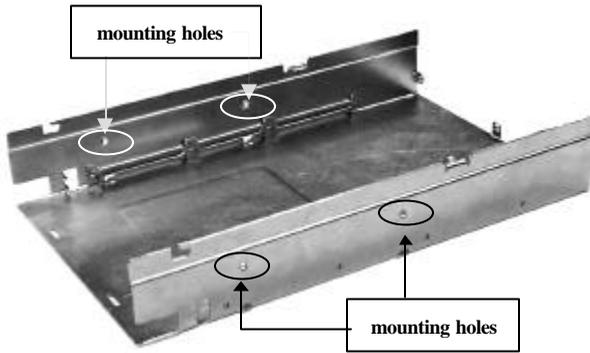
3.1.2 The Controller Main Board



3.1.3 Controller Main Board and Backplane

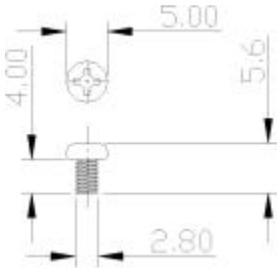


3.1.4 Mounting Holes:



The controller can be installed into an industry standard 5.25" half-height cabinet. 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 driven into the controller chassis should not extend 5.15 ± 0.3 mm. Longer screws may cause damage inside the controller. Use M3 screws for securing top cover.

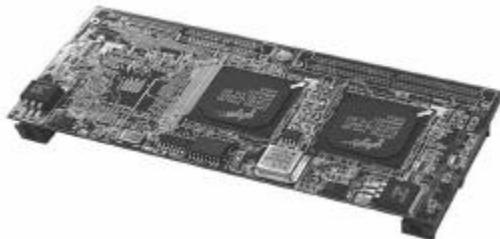
Use M3 (2.8mm thread) metric screws, 4mm long.



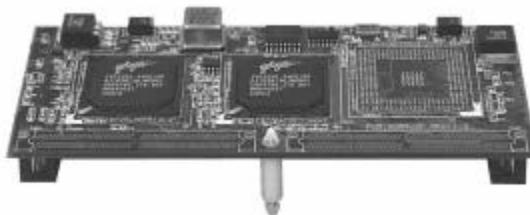
3.2 The Daughterboard

The optional daughterboard, IFT-9282FA, adds 2 Fibre channels. The daughterboard does not have docking connectors to connect to a backplane. Signals are transmitted through the upgrade sockets to controller main board. For the EonRAID 2000, the vertical backplane IFT-9288B6A (2 SCSI + 4 Fibre connectors) must be replaced by IFT-9288B6B (6 Fibre connectors) to upgrade to 6 Fibre channels. However, without the rear-side docking connectors, there might be a chance to mistakenly install the daughterboard in the wrong direction. ***If installed in the wrong direction, the controller will be seriously damaged.*** Please note that the side with a nylon spacer should be oriented towards the controller back panel.

| Models | Daughterboard | Controller Backplane |
|----------------|---------------|--------------------------------|
| EonRAID 2000-4 | None | IFT-9288B6A (4 Fibre & 2 SCSI) |
| EonRAID 2000-6 | IFT-9282FA | IFT-9288B6B (6 Fibre) |



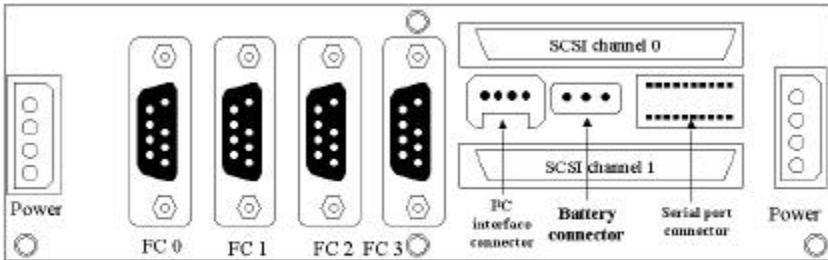
front view



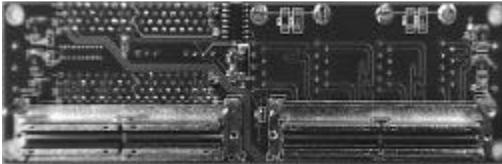
rear view
IFT-9282FA

3.2.1 Backplane Boards

A. IFT-9288B6A:



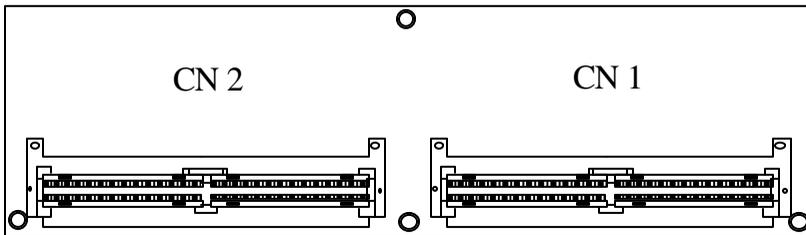
IFT-9288B6A
rear view diagram



front view (connect to controller main board; inside of the controller chassis)

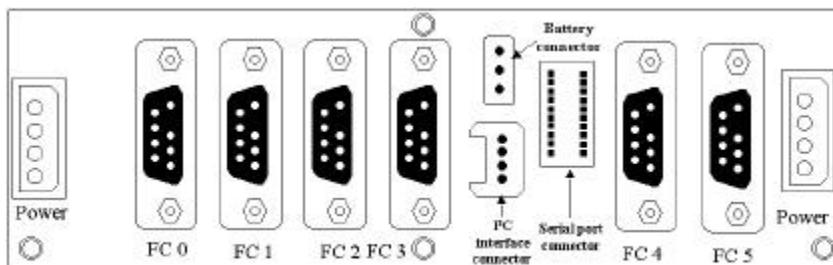
Note:

The SCSI channel 6 and channel 7 should be used as synchronized cache channels in a redundant controller configuration. Channels 0 to 5 are host and drive channels.



front view diagram

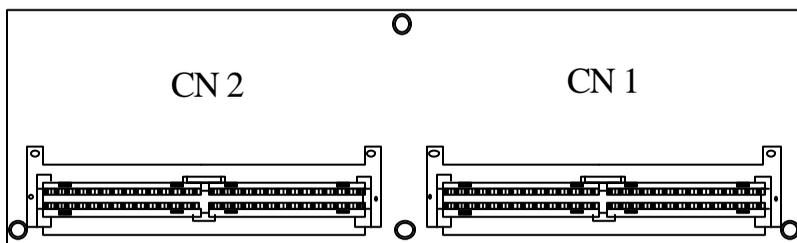
B. IFT-9288B6B:



IFT-9288B6B

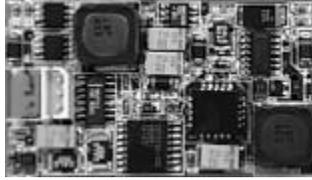
rear view diagram

(Backplane to the EonRAID 2000-6 main board installed with IFT-9282FA daughterboard)



front view diagram (connect to controller main board)

3.2.2 Optional Battery Backup Module



IFT-9070C

(Battery backup daughterboard for EonRAID 2000)



IFT-9010C

(Battery cell pack for EonRAID 2000)



IFT-9519

(Extension Cable for connecting and cascading battery cell packs)

3.2.3 Other Accessories

Included in kit:



IFT-9512

(Serial port combo cable)



IFT-9011

Null Modem



IFT-9531

Bezel key

Not included in kit:



(serial port combo-cable
for redundant controller configuration)

Hardware 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 capacity to both controllers in a redundant controller configuration.
3. Install the controller in the server/enclosure and attach the SCSI/Fibre/serial cables and terminators as needed.
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. Requirements for using the configuration utilities:

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

 - LCD front panel does not require any preparation.
 - Firmware embedded configuration utilities: the RS-232 communication between host computer and controller should be established.
 - Text-Based Manager: communicates through the host-controller Fibre connection using the In-Band Fibre protocol or RS-232 connection. Host-side parameters should be adjusted before the host computer can "see" the controller.
 - Java-Based GUI RAID Manager: communicates through the host-controller Fibre connection using the In-Band Fibre protocol. Host-side parameters should be adjusted before the host computer can see the controller. This is especially the case when users start configuring a RAID with the GUI manager from the beginning.

The management software listed above can use Fibre channel cabling and protocols to manage a RAID controller. However, a host computer can only "see" a RAID controller when certain number of disk drives have been configured into logical units and mapped to host ID/LUN. The other way for a host to see a RAID controller is to configure the controller as a peripheral device.

6. Configure and initialize your RAID.

WARNING!

Before proceeding with 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.

Notice for Unpacking:

Provide a static free environment to unpack before installing the controller components. Most of the RMA's Infortrend receives 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 surface and put on a grounded anti-static wrist strap. For example, if the system unit is connected to a grounded outlet you can touch any part of the system's unpainted metal chassis. The controller is packed inside an anti-static bag and foaming. Remove the controller carefully and inspect if it is damaged. If the controller appears damaged, please contact Infortrend for assistance.

4.2 Ventilation

Infortrend RAID controllers use a convection-cooled processor. Airflow across the heat-generating chips is required for operation within the normal temperature range. An enclosure capable of providing sufficient airflow across the controller board surface is required. Controllers and drives should be operating under an ambient temperature environment 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. Possible obstruction in the path of airflow should be removed. Make sure that airflow through the ventilation holes of the controller chassis is not obstructed.
3. Preheated air from other equipment in the enclosure should not be drawn into the controller.

4.3 How to Install/Upgrade SDRAM DIMM's

1. *The EonRAID 2000 controller requires a minimum of 32 Mbytes SDRAM DIMM (with or without parity-checking function) installed in the DIMM socket in order for it to operate. The controller is normally delivered without any SDRAM installed.*
2. *Do not remove memory from the anti-static bag until you are ready to install.*
3. *Do not lay memory on top of the anti-static bag. Only the inside of the bag is anti-static.*
4. *Handle memory module by holding its edges.*
5. *Avoid touching the chips and connector pins.*
6. *Avoid carpet, plastic, vinyl, and styrofoam in your work area.*
7. *Make sure all components are room temperature before working with them.*

CAUTION:

Static electricity can damage electronic components, including SDRAM. Before touching the memory module, discharge your body's static electric charge by touching a grounded and unpainted metal surface. For example, if the system unit is connected to a grounded outlet you can touch any part of the system's unpainted metal chassis.

How to Install/Upgrade SDRAM DIMM's

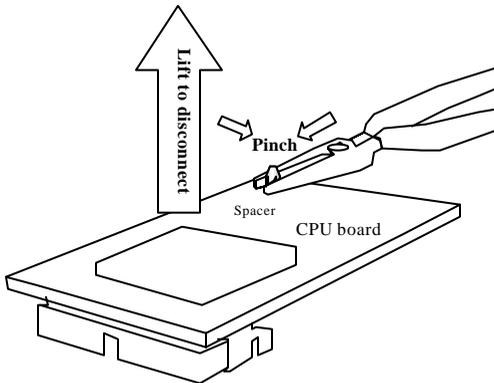
The following are guidelines on using SDRAM:

- Use 168-pin SDRAM DIMM 3.3V module (buffered/unbuffered DIMM are supported). SDRAM DIMM's that meets PC-100 standard is recommended. A DIMM with or without parity can be auto-detected by the controller. A DIMM with parity is recommended for security.
- In the redundant controller mode, both controllers should have the same capacity of memory.
- When introducing a new type of memory module, do stress test for more than 24 hours to ensure the memory compatibility.
- The minimum SDRAM required is 32Mbytes installed in a DIMM socket, however, greater memory size is recommended.

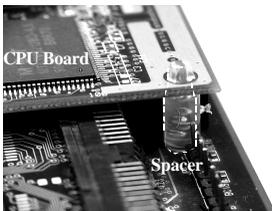
- The controller supports 32MB to 1GB SDRAM DIMM modules.

To install the SDRAM DIMM:

1. Before installation, make sure that there is no power connected to the controller. Anti-ESD (Electrostatic Discharge) methods should be applied.
2. Remove controller main board from the controller chassis. If there is a battery module installed, also remove it from the controller main board.
3. Remove daughterboard before installing or replacing DIMM's. It is a must to remove CPU board. The CPU board is secured by a nylon round spacer. Use tools like a needle-nosed plier to pinch the end of nylon spacer together and lift the CPU board slightly to release it from the spacer, and then grasp the CPU board by the board edges and pull carefully to remove.

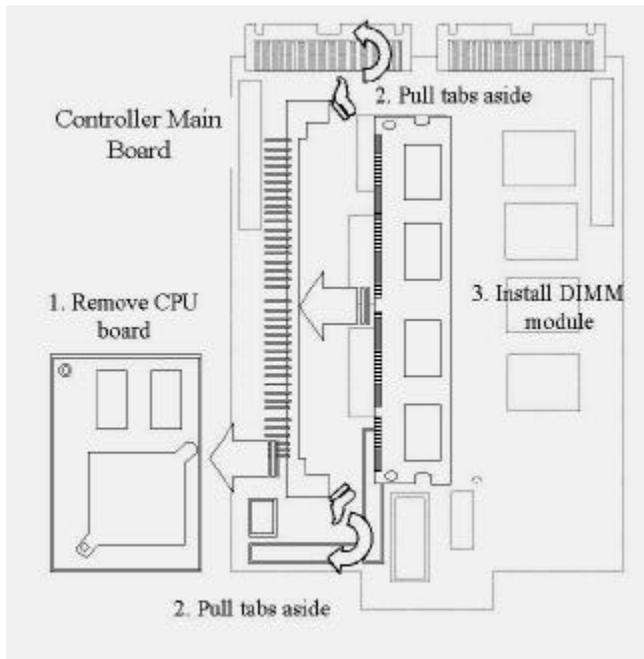


Removing CPU board



CPU board spacer viewed from the rear side

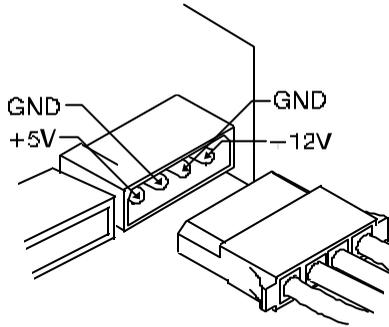
4. Pull the tabs at the ends of the DIMM socket aside.
5. Replace the DIMM module if upgrading to a new one. Position the DIMM towards the socket with the notches in the module aligned with the keys on the socket.
6. Insert the DIMM module horizontally into the socket. Make sure it fits firmly into the socket. The tabs will hold the DIMM in place.



7. Before re-installing CPU board, make sure the spacer is in its original position. Install CPU board, daughterboard, and battery module back to the controller main board. Although the CPU board connectors are designed to avoid incorrect installation, install the CPU board carefully and do make sure that the Pin 1 locations of all connectors are correct.
8. Install the controller main board back to its chassis and you should be able to read the cache memory size after the controller is powered on.

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.



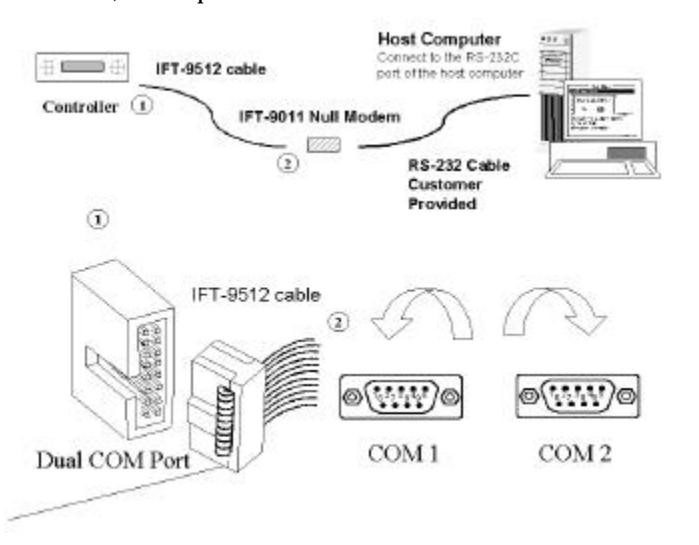
4.5 How to Connect RS-232C Terminal Emulation

The controller can be configured via a PC running a VT-100 terminal emulation program, or a VT-100 compatible terminal. The provided IFT-9512 cable converts the RS-232C signals of the 20-pin header on the controller backplane into two 9-pin D-Sub male connectors, one for COM 1 and the other for COM 2. The pin layout of the 9-pin D-Sub male connectors is similar to that of a PC's serial port and is set as a DTE device. The proper connection of the cable and pin layout is displayed in the following diagram. Each DB-9 connector is marked as "COM 1" or "COM 2." Please use the connector marked as "COM 1" for terminal emulation.

Connecting Serial Port 20-pin Connector

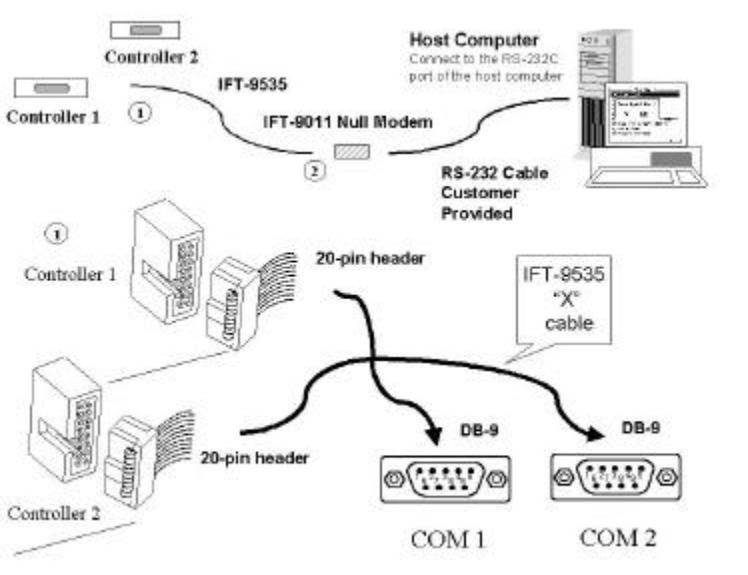
Locate the 20-pin serial port connector on the vertical backplane (please refer to Chapter 3 for details), and plug in the plastic 20-pin header of the IFT-9512 cable.

Connect the DB-9 connector marked as "COM 1" (on the other end of the IFT-9512 cable) to the supplied IFT-9011 (null modem). From the other end of IFT-9011, connect a serial port cable to the host computer's (terminal's) serial port or to the outside of the enclosure.



IFT-9535 "X" cable

When configuring two independent controllers into a redundant mode, an "X" shape cable (IFT-9535) is required to connect the serial ports on both controllers to the host computer. There is a primary-secondary relationship between redundant controllers. If one of the controllers should fail, the existing controller will respond to host I/O requests as the primary controller regardless of its original status. Although only the primary controller responds to user's configuration, yet it is not predictable which one of the controllers 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 port 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. Use the serial port connector on the controller backplane.
- In most cases, connecting RD, TD and SG are 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.
- On the Hyper Terminal of Windows 2000, due to its misinterpretation, the arrow keys might not work properly. The following key combination 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 Parms  ↓
```

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

```
Communication
Parameters ..
```

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

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

Select "COM1 Configuration," and 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 2 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 terminal must be identical.

IMPORTANT!

Viewed from the LCD panel, the “COM 1 configuration” in “Communication Parameters” must be set as “Comm(unication) Route Dir(ect)” and “Term(inal) Emul(ation) Enab(led)” for the terminal to work.

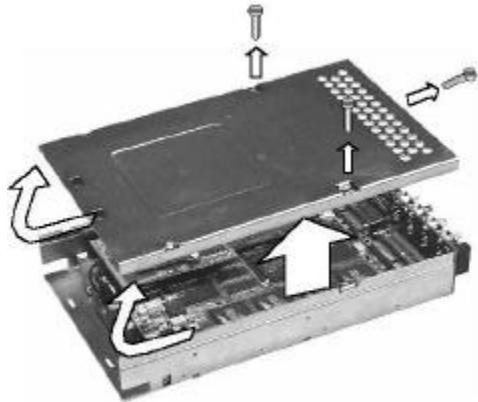
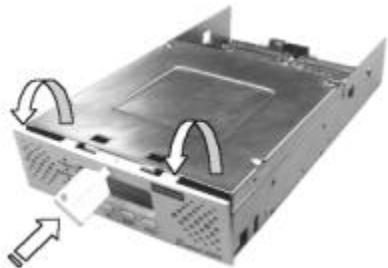
4.6 Installing Daughterboard

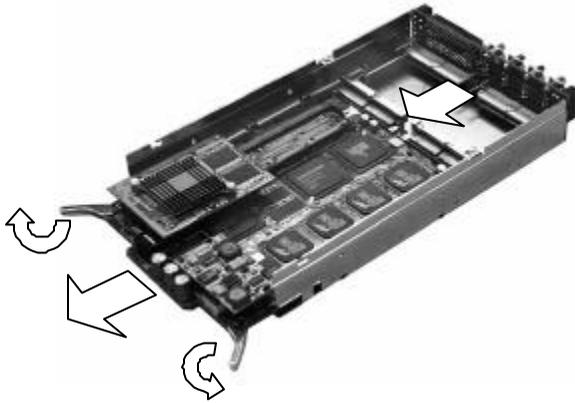
Apply anti-ESD methods before installation.

Use screws provided by Infortrend only. Longer screws may cause electric shorting.

Turn OFF power to the controller and disconnect power cords from the controller backplane.

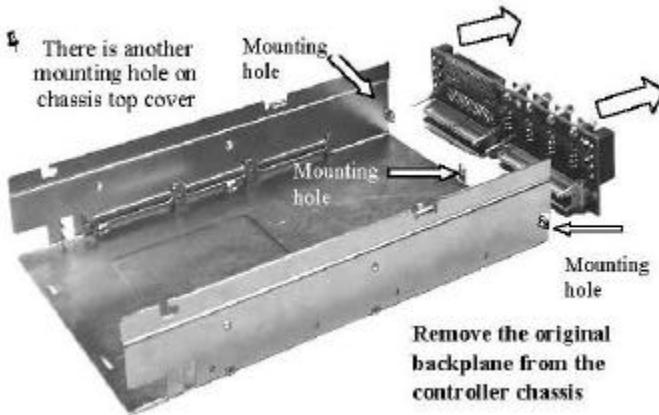
After you power off the controller and disconnect the power cords, remove the front panel and top cover of your controller. First, use a bezel key or a straightened paper clip to remove the front panel. Insert the bezel key into the ejection hole in the middle of front panel and lever down a bit to remove it. Disconnect the front panel ribbon cable from the front panel module. Second, unscrew the four fasteners on the sides of top cover to remove it.

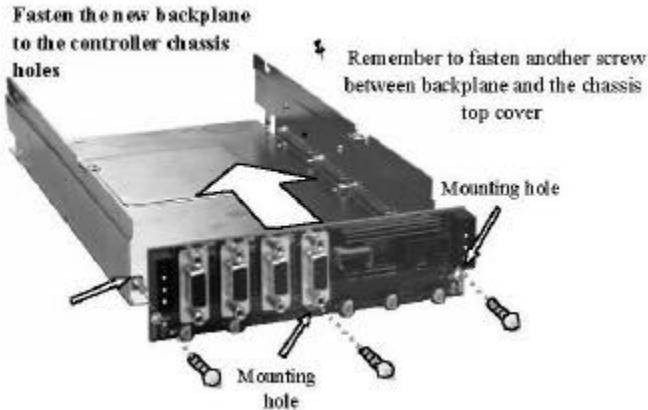




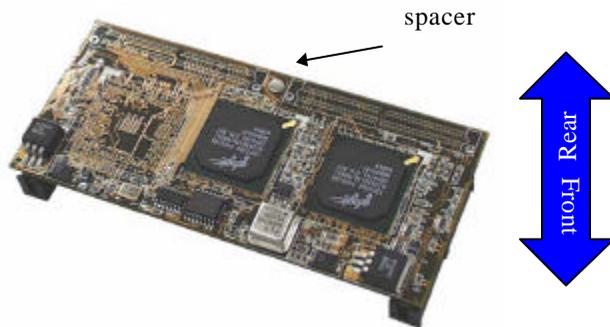
Use the eject levers in the front of main board to remove the controller main board.

Replace the original backplane IFT-9288B6A with the IFT-9288B6B to upgrade to 6 Fibre channels. Locate the mounting holes on the back of controller chassis, unscrew and replace the backplane with the new one.



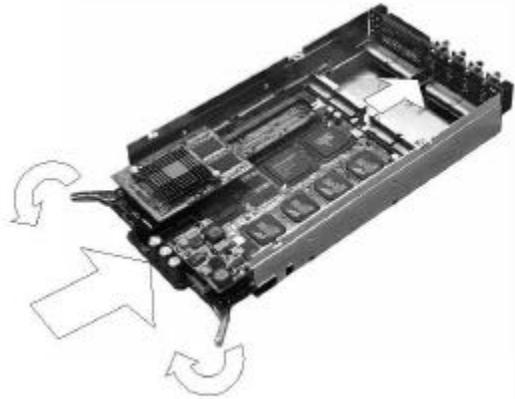
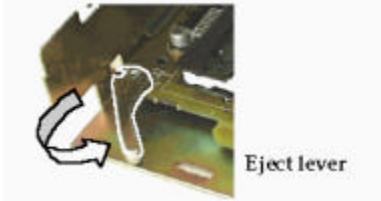


⚠ Please note that the daughterboard can be installed in the wrong direction and cause serious damage to the controller. Make sure to orient the side with a nylon spacer towards controller backplane.



Install daughterboard to the daughterboard upgrade sockets, JP11 and JP 12, on controller main board. Gently slide the main board into the controller chassis. Make sure the main board reaches the end of the chassis and is inserted properly into the metal grooves on each side of the 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 edges of the metal groove. “The docking connectors” on the main board must be joint with that on the controller backplane.



Install top cover back to its normal position and connect the LCD panel ribbon cable. Insert the LCD front panel into the front opening of controller chassis. If you have removed the controller from an enclosure, follow the instructions provided by the enclosure manufacturer. Attach power cables and Fibre or SCSI cables. Connect other interfaces to your controller: RS-232C, I²C, etc.

When finished with hardware installation, you may refer to Infortrend’s *Generic Operation Manual* for instructions on how to re-configure your RAID system. If your controller initializes successfully, you will be able to start “View and Edit Fibre/SCSI Channel” to see if your newly added channels are correctly recognized by your controller.

NOTE:

When two controllers are configured in redundant controller configuration, it is a must to shut down the host computer(s) and both the Primary and the Secondary controllers to proceed with installing a daughterboard.

4.7 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 under the following 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 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.

4.7.1 Controller Main Board Removal

1. To prevent damage to components by ESD, it is recommended that an anti-static wristband be worn.
2. Power down the system.
3. Remove the bezel (front panel) by using the included bezel key, or a straightened paper clip. Insert the bezel key into the small hole located at the top center of the controller front panel and lever the key down to remove the panel. You must then remove

the gray ribbon cable connected between the front panel and controller main board.

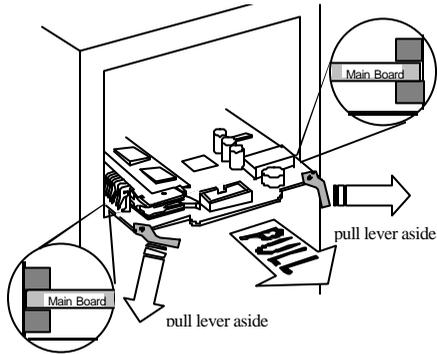


Use the bezel included in the package to remove front panel module.



Unplug the ribbon cable which connects between the front panel module and the controller main board.

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

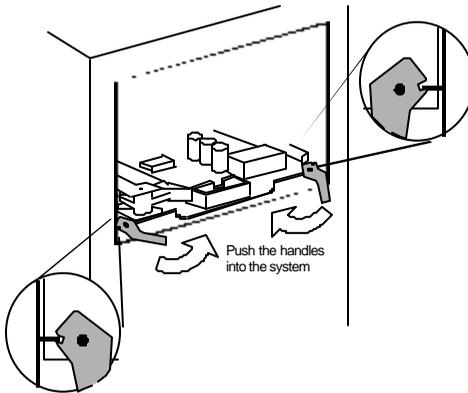


You may now pull out the controller's main board.



4.7.2 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 the main board reaches the end of controller chassis and is inserted properly into the metal grooves on each side of the chassis.
3. 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 edges of the metal groove.



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

4.8 How to Install/Replace Battery Backup Module

The controller operates with cache memory. However, if the controller operates with write-back caching and a power failure occurs, the cache memory may contain buffered data that has not yet been written to the hard disks. This buffered data will not be retrievable when power returns. The battery cell pack IFT-9010C holds three 3A/H Nickel Metal Hydride (NiMH) rechargeable batteries, and is connected to a charger circuit daughterboard IFT-9070C. The combination of the IFT-9070C allows another battery pack to be daisy-chained for longer backup time.

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 circuits 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 the fast charging, the charger will shift to a trickle stage until the charge is full.

4.8.1 IFT-9070C Battery Backup Daughterboard and IFT-9010C Battery Cell Pack Combination



IFT-9070C

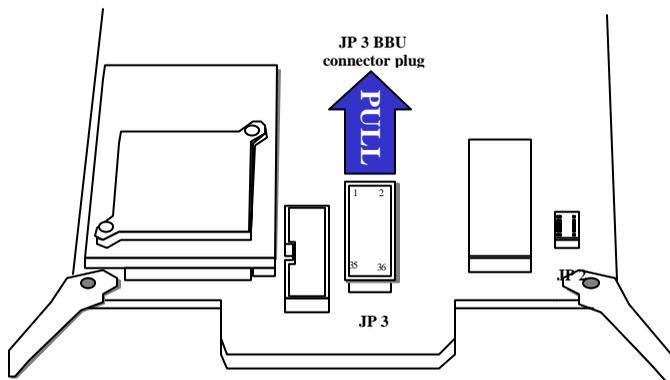


IFT-9010C

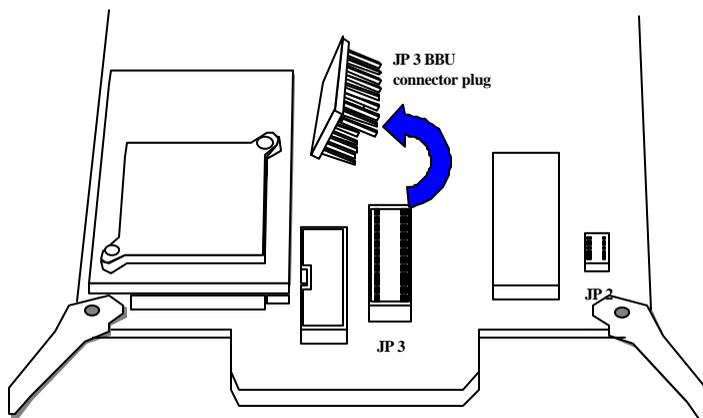
The combination of the IFT-9070C daughterboard and IFT-9010C battery cell pack can provide up to 72 hours of backup time when the controller's cache memory is using a 32 MB SDRAM DIMM. The IFT-9070C is a daughterboard that is plugged into the main board. The IFT-9010C is a pack of battery cells that connects to the battery connector located on the backplane board. An IFT-9519 extension cable is available for connecting and cascading cell packs.

To install the IFT-9070C battery backup daughterboard and IFT-9010C battery cell pack:

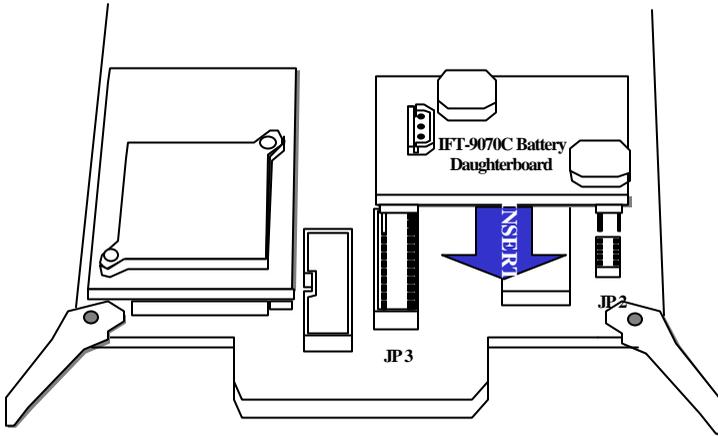
1. Make sure all power connections to the controller and drives are turned off. Anti-ESD methods should be applied.
2. Remove the controller main board from the enclosure (please refer to section 4.6)
3. Locate the BBU socket plug that is inserted in the female pin socket JP 3 (refer to the diagram below).



4. Remove the socket plug that is on JP 3. (Keep the socket plug in a safe place for future use). The socket JP 3 must be installed with either the socket plug or the battery backup daughterboard.



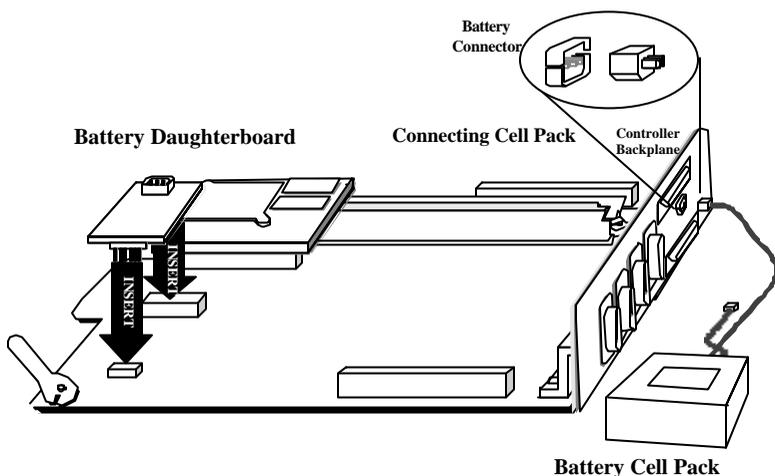
5. Now install the IFT-9070C daughterboard onto the controller main board.



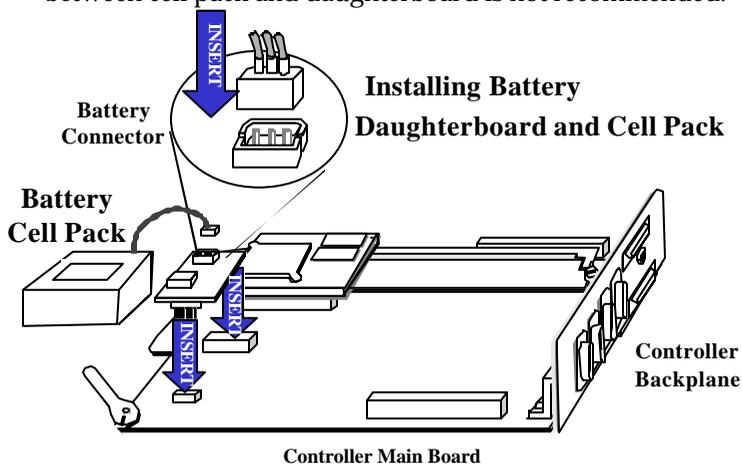
6. There are two ways to connect the IFT-9070C daughterboard and the IFT-9010C cell pack:

The first is, install IFT-9070C on main board and connect IFT-9010C to the battery connector on controller backplane (J 4).

The second is, install IFT-9070C on main board and connect to the IFT-9010C directly, using the 3-pin battery connector on daughterboard.



7. Connect the IFT-9010C cell pack to the battery connector located on the controller backplane (J2) as shown above; or, connect the IFT-9010C battery cell pack directly to the IFT-9070C daughterboard as shown below. Unless your controller is housed in an OEM canister which provides extra space and mounting positions for the cell pack, the direct connection between cell pack and daughterboard is not recommended.



8. Remember to enable write-back caching for better performance. If redundant controller configuration is preferred, both should be installed with a battery module.

9. Attach the included connector plug to the unused connector of your cell pack to prevent shorts between pins and enclosure PCB board.

IMPORTANT!

1. *You must install the socket plug back to JP3 once you have removed the IFT-9070C daughterboard. The controller will not work if you fail to do so. Also, pin 1 of the socket plug must be installed to pin 1 of the JP3. The pin numbers are printed on the socket plug and pins have been key-blocked to prevent incorrect installation. Please refer to Appendix D for the pin 1 location of JP3.*
 2. Inspect regularly and replace every two years; use official battery pack replacement and use with specified RAID controllers only.
-

Removing Battery Module

1. Power off the system. Make sure cache status is clean or use the “Shutdown Controller” function to flush the cache content before powering down the system. Power down host computer first to allow controller to finish all the cached writes.
2. Remove controller main board from its chassis. If the cell pack is connected via backplane, disconnect the linking cable from backplane connector.
3. Remove battery daughterboard by grasping its edges and pull it off from the controller main board. Please remember to install the socket plug back to JP 3.

4.8.2 Battery Backup Module Operation

Notice for the first installation:

- 1. It is possible that the linking cable connected between the IFT-9070C daughterboard and the 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 damage the plastic shielding of battery linking cable. If the cell pack is not cascaded with another cell pack, you should attach the included connector plug to the unused connector to avoid shorts by the contact between connector pins and PCB.*
- 2. Batteries have a tendency to remember its charge capacity. . A shortened charge time will affect the capacity. In order to make use of all the capacity of your battery cells, allow the battery 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 complete 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 to supply power to refresh memory.*
- 3. It is a must to disconnect battery module before replacing DIMM module.*
- 4. During normal use, an empty IFT-9010C takes about 20 hours to recharge.*
- 5. Disconnect battery module if there is a long storage period before deployment. Extreme storage condition should be avoided (<-20 °C or >40°C, >65% ± 10%).*

4.9 In-band SCSI/Fibre

4.9.1 What Is It and Why Do You Need It?

External devices require communication with the host computer for device monitoring and administration. This is usually done through RS-232C ports.

Infortrend offers an alternate means of communication for its RAID controllers—In-band SCSI/Fibre. The traditional way for RAID controllers to communicate with the host computer has been via software using an RS-232C connection. With In-band SCSI/Fibre, integrators have more flexibility. They may use RS-232C or the existing SCSI or Fibre cable instead. The host can "see" the controller only when certain number of drives are assembled into logical units and mapped to host LUNs; or, when the controller is configured as a peripheral device.

4.9.2 How does it work with the SCSI or Fibre cable?

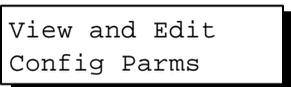
In-band SCSI/Fibre technology translates the original commands into standard SCSI or Fibre commands. These SCSI/Fibre commands are then received by the RAID controller. It can be used to communicate between host and controller. The RAIDWatch manager can administrate the RAID controller without additional communicational interfaces. (Note: It is assumed that users of In-band SCSI/Fibre possess the following: a third-party SCSI/Fibre adapter and a channel on their RAID controller that can be designated as a host channel). Both of these are required for In-band SCSI/Fibre communication between the host and the RAID controller.

4.9.3 How Do You Configure the Controller to Use In-band SCSI/Fibre?

4.9.3.1 RAID Controller Adjustments

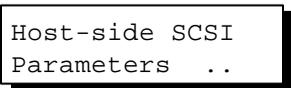
Use the front panel to configure the In-band SCSI/Fibre settings.

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



```
View and Edit
Config Params
```

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



```
Host-side SCSI
Parameters ..
```

You will 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. Look at the table below to find the proper settings for your host operating system.

Peripheral Device Type Parameters Reference 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 2.5.x/2.6 (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

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 |

Example: Settings for Windows NT 4.0

The settings for Windows NT 4.0 are provided here as an example. For the settings for other operating systems, please refer to the table above, *Peripheral Device Type Parameters Reference for Various Operating Systems*.

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."

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.

```
Device Qualifier
Connected
```

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 Undefine LUN."

```
LUN Application-
All Undefine LUN
```

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

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

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

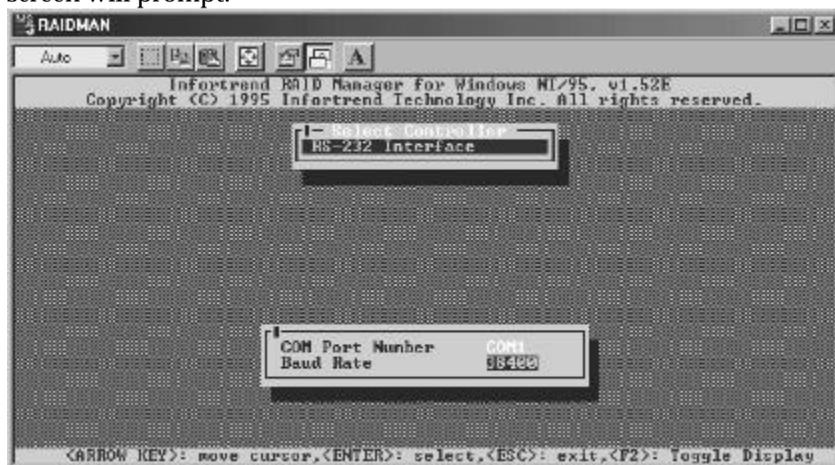
```
LUN Application-
Undefine LUN-0's
```

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

4.9.4 Using TextRAID Manager

4.9.4.1 Connection — Using RS-232C

To configure your RAID through TextRAID Manager, use RS-232 to connect your host computer to the controller. Insert the "Drivers and Utilities" CD provided by Infortrend into your CD-ROM drive. Locate and execute the TextRAID manager program <drive letter of your CD-ROM drive>:\3102\RaidUtils\WIN95\Raidman.exe. The initial screen will prompt.



Change the COM port number to where you have connected the RS-232C serial and also set the baud rate identical to the baud rate setting of your controller. You may also refer to the *Generic Operation Manual* for more details.

When finished with configuring the COM port and baud rate, press **[ESC]** to proceed.



Choose Yes to establish the connection between host and controller.

Select “Controller Maintenance” or “Terminal Emulation” and press **[ENTER]** to proceed.



Now you can configure your RAID by the TextRAID manager. The terminal emulation operations will be discussed in the *Generic Operation manual*.

4.10 Getting Ready to Use

4.10.1 Cabling Topologies

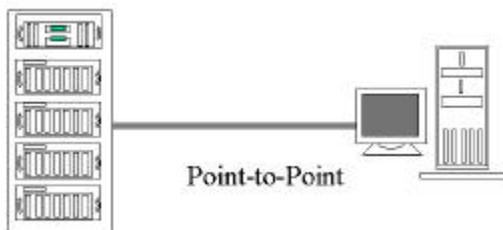
Host-Side Topologies:

HBAs:

Fibre channel is widely applied to storage configurations with topologies that aim to avoid loss of data by hardware failure. If possible, every connection between source and target should be configured in a redundant pair. For the part of integrating RAID controllers into a storage system, the recommended host side connection should consist of two host adapters. Each host adapter should be used to configure a Fibre loop between host computer and storage. In active-to-active redundant controller mode, the primary loop serves the I/O traffic that is directed to the primary controller; and its pair loop serves the secondary controller. The host-side software support is necessary. The management software on host computer should be able to direct I/O traffic to the pair loop under the situation that one of the loops should fail.

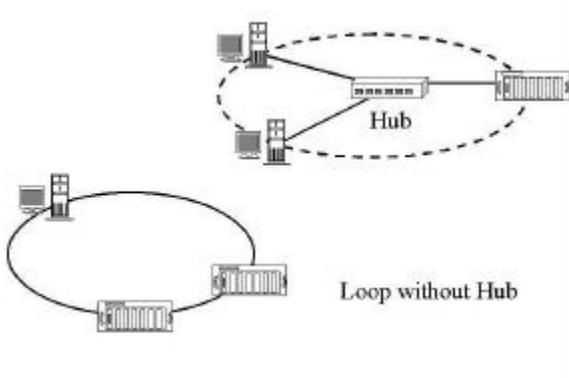
1. Point-to-Point Topology:

The connection between RAID system and host computer has the dedicated bandwidth. Point-to-point topology is not recommended for the EonRAID 2000-4 and 2000-6 unless external bypass service is provided. There is no limitations of this nature for the EonRAID 2000R1 and 2000R2 redundant solutions.



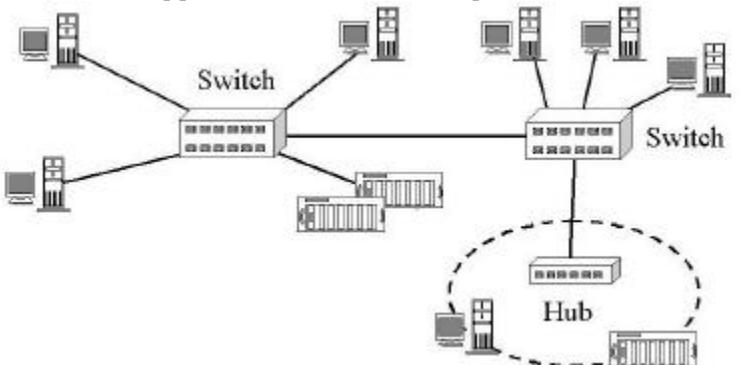
2. Arbitrated Loop and Hub Topology:

A Fibre hub allows a star-like configuration of Fibre loop. Total bandwidth is shared via an arbitration scheme among node-to-node connections. An example of private loop is diagrammed below.



3. Switched Topology:

Every node (a device connected on Fibre channel) communicates with another via a switch. A switch provides scalable bandwidth to the connection between nodes. Shown below is an example of Fibre switches and a public loop. If there is a need to configure two controllers into redundant mode and connect to a switched fabric, configure the two controllers in a public loop configuration using external bypass module such a Fibre hub. The EonRAID 2000R1 and 2000R2 support direct connection to ports on a Fibre switch.



Considerations for Redundant Controller Configuration:

Single Controller:

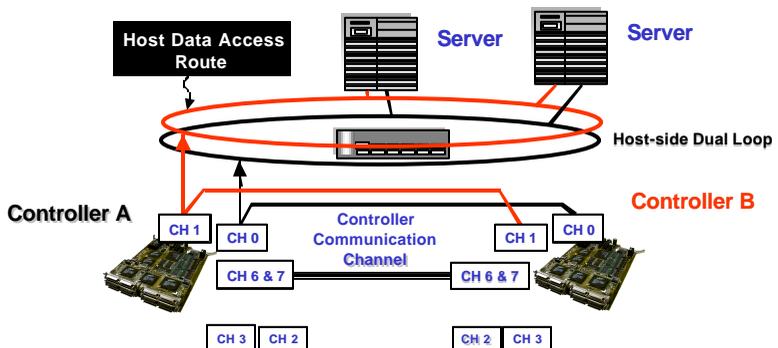
The controller's 1 GHz Fibre chips support single loop ID per channel. In the single controller mode, host should provide two HBA cards and the controller should provide another host channel as the redundant I/O path.

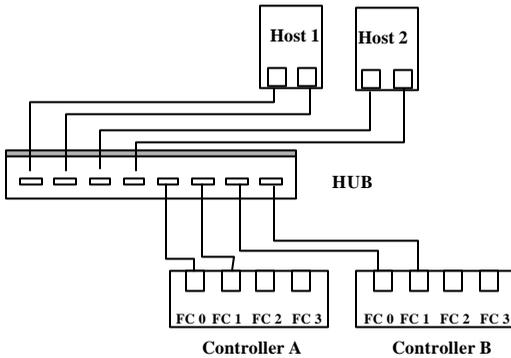
Active-to-Active Redundant Controller:

Since each Fibre interface chip only supports a single loop ID, two host adapters are necessary for the active-to-active redundant controller operation. Using two HBAs in each server is the requirement for configuring the EonRAID into redundant configuration.

Because each Fibre chip only supports a single loop ID, each host bus adapter should be used to constitute a data path connecting host to either the primary or the secondary controller. One should be configured to serve the primary controller, and the other the secondary.

- 1. Controller Configuration:** Configure, through firmware settings, two Fibre channels as host. Each host channel should be assigned with either a primary ID or a secondary ID. Create logical units and map each logical unit separately to either the primary or the secondary ID.
- 2. Physical Connection:** Each host channel should be connected to the same channel on the pair controller. Please refer to the diagrams below.





| Controller/Host Channel | Status | ID Mapping |
|-------------------------|---------|--------------|
| A/ Fibre channel 0 | Active | Primary ID |
| A/ Fibre channel 1 | Standby | N/A |
| B/ Fibre channel 0 | Standby | N/A |
| B/ Fibre channel 1 | Active | Secondary ID |

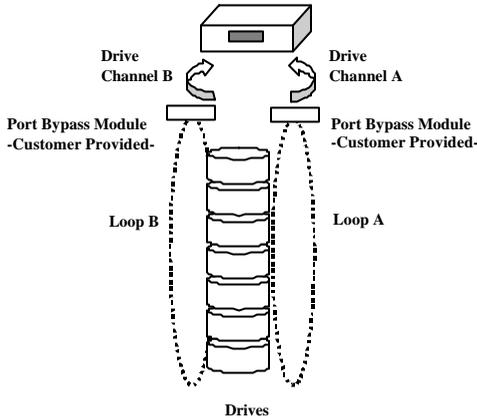
Should any of the controllers fail, the standby channel on a controller will become an I/O route serving the host I/Os originally directed to the active channel on its pair controller. Host should provide "application failover" software to control the transfer of I/Os from one HBA to another should either of the data paths fail.

Supported Configurations with Redundant Controller:

| Controller | Host/Drive Connection | Host-Side Topology | Drive-Side Topology | Sync. Cache |
|--------------------------|-----------------------|---|---------------------------|--|
| EonRAID 2000-4 & 2000-6 | Fibre-to-Fibre | Hub (private or public loop)/point-to-point | Drive Dual Loop supported | SCSI CH 6/7, dedicated Fibre or distributed over all drive loops |
| EonRAID 2000 R1 & 2000R2 | Fibre-to-Fibre | Hub/point-to-point/Fabric | Drive Dual Loop supported | SCSI CH 6/7, dedicated Fibre or distributed over all drive loops |

4.10.2 Redundant/Dual Loops:

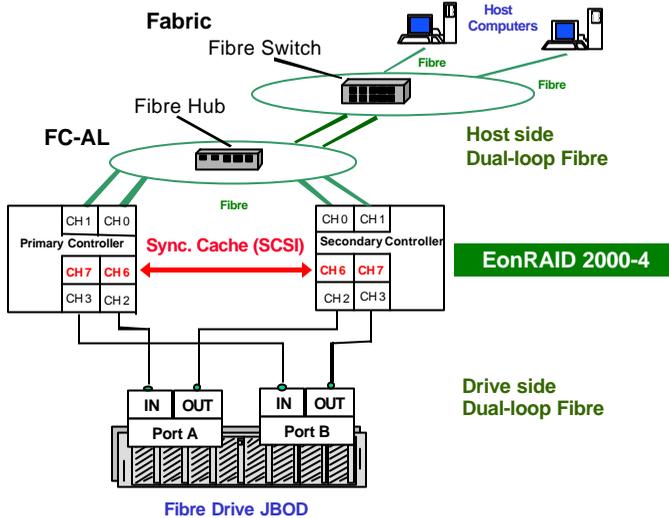
Drive-Side Dual Loop:



Fibre channel storage is usually configured with redundant data paths. Through the connection of backplane, Fibre drives in a JBOD form a circuit loop and the I/O outlets are provided as A port and B port. To configure a dual-loop, you may connect one drive channel of the controller to the A port and another to the B port of the Fibre drive enclosure. The dual-loop configuration not only doubles the traffic bandwidth by separating the data transmitting and receiving paths but also provides data bus redundancy.

If two of the drive channels are configured in a dual-loop, the drive loop status will be displayed as, for example, channel 2(3). The data bus will be operating at the bandwidth of 200MB/sec and this function is enabled by controller's default.

Redundant Controller + Sync. Cache



Considerations with Different Controllers

1. EonRAID 2000-4:

If redundant controller configuration is preferred, bypass circuits must be implemented externally. The SCSI interfaces should be connected as the synchronized cache communications channels.

2. EonRAID 2000-6:

Since there is no external SCSI connectors for the dedicated sync. cache communications, the EonRAID 2000-6 does not serve the purpose of redundant controller configuration. However, communication data between the two controllers can be assigned to a dedicated loop or distributed over the drive-side loops. This function will be implemented with new release of firmware and the phase II design of the 9288B6B backplane.

3. EonRAID 2000R1 and 2000R2:

Bypass circuits have been implemented with the EonRAID 2000R1 and 2000R2. Both support point-to-point, arbitrated hub, or switched topologies.

NOTE:

*Redundant configuration with two independent controllers (**EonRAID 2000-4**) can only be implemented in a private or a public loop. A hub hanging off switch is required before connecting to a switched Fabric. For the **EonRAID 2000"R"** series, direct connection to ports on a Fibre switch is supported.*

Fibre Loop Protection:

Single Controller:

Fibre loop protection is usually accomplished by implementing bypass (LRC) circuits on a backplane or using a Fibre channel Hub. Bypass modules are necessary outside the controller's connection to host and drive so that each dual loop configuration can sustain failure of single loop.

Redundant Controller:

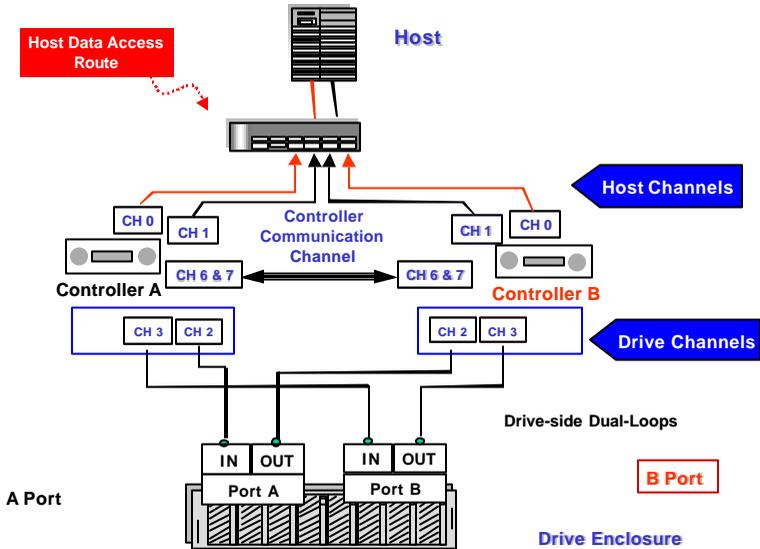
For the 5.25" half-height Fibre controllers EonRAID 2000-4 and 2000-6, by-pass modules must be provided externally. Unless bypass circuits are provided via a subsystem backplane, the redundant controller configuration requires external by-pass circuits for host interfaces such as that on a Fibre Hub so that single controller can failover and failback. A redundant controller configuration consisting two independent controllers requires cabling between the host interfaces on two controllers and ports on a Fibre Hub. A Fibre drive JBOD usually provides bypass circuits with I/O interfaces.

The direct connection of host channels to switch ports will suffer from a re-designation of port addresses once a controller failure occurs. If addresses are changed, host computer will not be able to access the original disk array. The LIPs (loop initialization primitives) that result from adding and removing devices will

affect the redundant configuration unless the controllers are configured in a public loop where I/Os directed to a failed controller can be bypassed to the existing controller. I/Os will be bypassed to the standby channels on the existing controller and the host computer will not acknowledge the controller failure. The surviving controller can transfer the original ID and I/O channel configuration to a replacement controller after the failed controller is replaced by a healthy one.

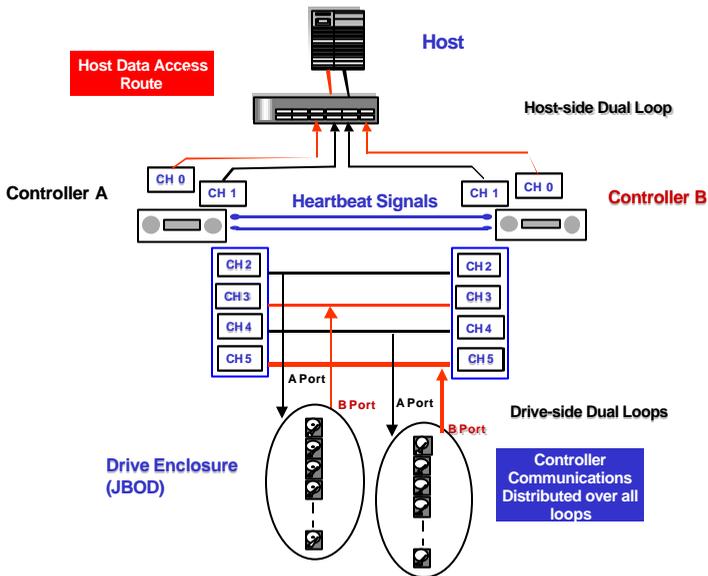
In general, protection for Fibre channel loop connectivity should be provided external to the 5.25" half-height controllers. There is no such limitation to the full-height redundant series. Failure to bypass FC ports of a failed controller will result in system downtime.

Sample Redundant Configuration Using EonRAID 2000-4 Controllers



| Channel | Configuration |
|---------|--|
| 0-1 | Host channel |
| 2-3 | First drive dual-loop |
| 6-7 | SCSI channels - synchronized cache communications - external cabling |

Redundant System with External Cabling-Fibre Loops

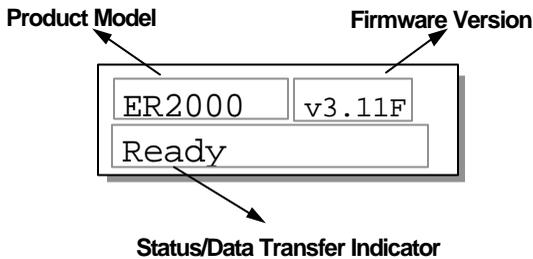


| Channel | Configuration |
|--------------------|--|
| 0-1 | Host channel |
| 2-3 | First drive dual-loop |
| 4-5 | Second drive dual-loop |
| 6-7 | N/A |
| RCC Communications | Configuration |
| 4-pin | Present detect signal communications through 4-pin connectors on controller backplane (9288B6B2) |

Two EonRAID 2000-6 RAID controllers are used in the configuration above. The controller-to-controller communications traffic can be configured as using one dedicated Fibre loop or distributed over all drive loops. Sync. cache communication path is user-configurable via firmware setting. A dedicated loop should not be connected to any other Fibre devices except the controllers. In the latter case, controller will automatically distribute the communications data over all drive loops. The controller backplane, 9288B6B, provides two 4-pin connectors for controller-controller present detect communications.

4.10.3 Power on the System

1. Power on the RAID system.
2. Refer to the following diagram on how to read the LCD screen.



3. The front panel LCD should light on. A few messages will appear on the LCD for a short while.

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

This screen is accompanied by two “beeps”.

```
ER2000    v3.11F  
No Host LUN
```

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 -

```
ER2000 v3.11F  
Ready
```

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

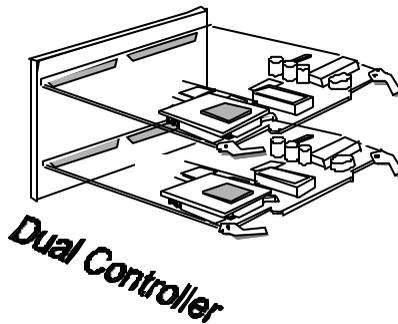
Dual Redundant Chassis: EonRAID 2000R1 & R2



EonRAID 2000R series

5.1 Overview

The EonRAID 2000R controller is an external, hot-swappable, and dual redundant solution based on the 64-bit EonRAID controller architecture. The 5.25" full-height dual redundant chassis simplifies system integration with dual-controller configuration. 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 by a replacement controller online.



In the past, integrating two independent controllers into the redundant mode meant complex cabling, configuration difficulties, and the risk of

bus failure. Cabling between the two controllers usually includes host and drive SCSI or Fibre channels, communication channel for write-back cache synchronization, and the failover/failback connection. With these connections interfaced through a controller backplane, system integrators need only to connect to the host(s) and drives. No additional cabling connections between the two controllers are required.

Solutions:

| | |
|------------------------|----------------------------|
| EonRAID 2000R 1 | Redundant 4 Fibre channels |
| EonRAID 2000R 2 | Redundant 6 Fibre channels |

NOTE:

Redundant controller configuration using two independent controllers can only be implemented in a FC-AL public or private loop. A hub hanging off switch needs to be implemented before connecting to Fabric. For the EonRAID 2000 "R" series, point-to-point connection to a Fibre switch is supported. MIA conversion is necessary.

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 EonRAID 2000R manually. The configuration procedure is very 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 mode, configure each controller separately. Configure each controller separately 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. The two controllers will start the negotiation between and come online in the redundant configuration.

Follow the steps listed below to configure your dual redundant controller.

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 enclosure. Make sure your host and drive channels are properly connected.
3. Connect the host channel of your controller to the host computer, a Fibre hub, or a Fibre switch. If the LUN Filtering function is desired, check the WWN number that is available with your HBA card for host-side connection. You may reboot server and check in the content of HBA BIOS. The WWN number of server's HBA is necessary when assigning LUN Filtering entries. The LUN filtering function decides if a SAN server is allowed the access to your RAID. Different servers in a SAN environment can be included or excluded from the access route. During redundant controller configuration, a unique controller identifier should be entered for each controller. The

unique identifier will be generated into a controller-unique WWN number.

4. Remove one of the controllers from the main chassis and start to configure the remaining controller.
5. Create logical drives, logical volumes, or logical partitions and assign logical units to either the primary or the secondary controller. Map logical units to either the primary or the secondary controller ID on different host channels. Set drive channel primary controller ID as 119 and secondary controller ID as 120.
6. Enable the "redundant controller" function from "View and Edit Peripheral Devices/Set Peripheral Device Entry" and set the controller as the primary controller.
7. Remove the controller you have configured 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 also as the primary controller. Set drive channel primary controller ID as 119 and secondary controller ID as 120.
8. Remove the controller from the main chassis, and then install both controllers into the main chassis. Firmware will decide which is the primary and which is the secondary controller.
9. After the controller negotiation process is completed and the host is rebooted, the host should be able to access the storage capacity in RAID. You may also refer to the *Generic Operation Manual* for more details on redundant controller configuration.

Mounting:

The relative locations of mounting holes are the same as EonRAID 2000. Use the same mounting screws.

Important Features:

The EonRAID 2000R supports active-to-active redundant controller operation with synchronized write-back cache communication. DIMM's of identical capacity must be installed in two controllers.

Supported Fibre Topologies:

- Point-to-Point Topology: direct server-to-storage connection.
- FC-AL, Private Loop Topology: a Fibre Hub is required.
- FC-AL, Public Loop Topology:
An arbitrated loop using Hub connected to a switched fabric.
- Fabric Topology: Switched Fabric; MIA conversion is necessary for connection to optical fiber

The host-storage connection should be properly defined via firmware setting. The controller default is FC-AL, which is appropriate for most Fibre channel applications.

S.E.S. Implementation

S.E.S. can be implemented through the connection to the S.E.S. service device or passed through a hard drive.

When access to S.E.S. service is through a disk drive and passed through to the S.E.S. device, the implementation has the benefit of cost-effectiveness but the service will fail if the drive fails.

Ventilation:

An efficient airflow must be maintained through the chip surfaces of controller.

Infortrend RAID controllers use a convection-cooled processor; therefore, a constant airflow across the heat-generating chips is essential for operation within the normal temperature range. The RAID enclosure where the controller is installed must provide sufficient airflow. Controllers and drives should be operating under an ambient temperature environment 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 on controller chassis is not obstructed.
3. Preheated air from other equipment in the enclosure should not be drawn into the controller.

Battery Modules:

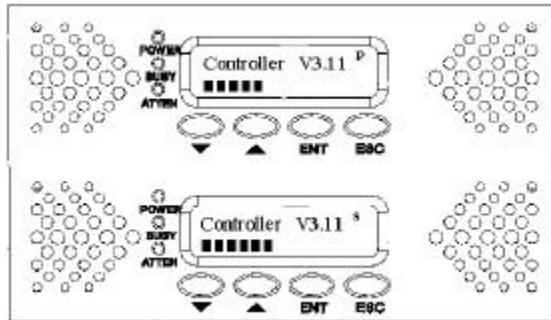
Identical to the EonRAID 2000, the "R" series uses the combination of IFT-9070C daughterboard (charger circuit) and the IFT-9010C cell pack to protect cached data.

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 daughterboards onto both controllers. Both controllers should be installed with independent battery modules. Please refer to the previous chapter for more details. Install controller main boards and make sure the square-shaped notches on the eject levers lock onto the edge of the metal groove. Push the eject levers inwards to make sure the controller

docking connectors are properly connected. Connect the IFT-9010C battery cell pack to J4 and J40 on the controller backplane.

Front Panel LCD Display:



The "R" controllers are equipped with independent LCD displays. Although the LCD panel of the secondary controller will not respond to user's configuration, the data throughput will still be displayed 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.

Front Panel Indicators:

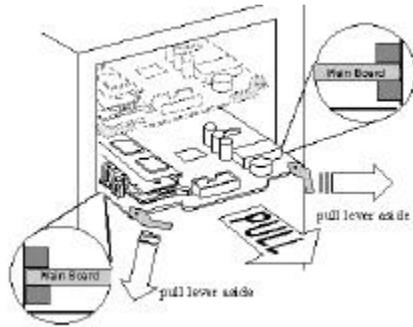
Front panel indicators are the same as those of the EonRAID 2000, please refer to chapter 3 for details. Each front panel displays the status of the relative controller.

Removing and Installing Controllers

To remove a controller main board from the EonRAID "R" series to replace the failed controller or to install DIMM's, do the following:

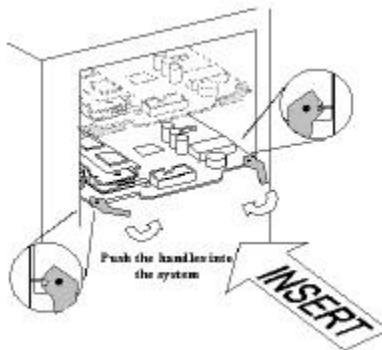
1. To prevent damage to components caused by ESD, it is recommended that an anti-static wristband be worn.
2. Use the included bezel key (IFT-9531) to remove the front panel. Pull the "eject levers," located in the front of the controller on both sides, to the side. Make sure to pull each lever outwards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

3. Disconnect the 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 ESD damage 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. You should be able to hear a “click” sound when the tenons of the front panel module slide into the mortises on controller chassis.

DIMM Installation:

DIMM installation to the "R" series is the same as installing to a EonRAID 2000. It should be noted the cache memory size must be the same on both controllers. Be sure that all power (including the optional battery modules) is disconnected from the controller before installing DIMM module. 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 of the EonRAID 2000, please refer to Appendix D for details.

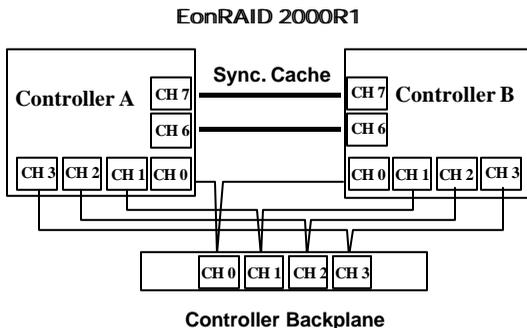
5.2 Solutions:

EonRAID 2000R1

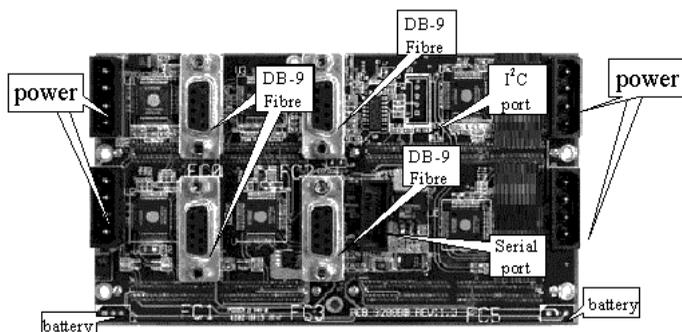
Channel Bus

The EonRAID 2000R1 is designed for Fibre-to-Fibre operation in a Storage Area Network. Each controller in this configuration uses channels 6 and 7 as the communication channels (synchronizing cache content, failover/failback signals, and the configuration data). Fibre channels 0 to 3 are host and drive channels. The default for host are channels 0 and 1. By-pass circuits have been implemented with every Fibre channel to maintain loop integrity.

The controller backplane is a combination of all signal paths and the communications between controllers. Should one controller fail, the existing controller will obtain the control of signal paths and serve all the I/O requests. Other interfaces are the same as those of the EonRAID 2000. Logical units can be assigned either to the primary or the secondary controller via firmware configuration. Workload can thus be divided among I/O processors. In the event that one of the controllers fails, the other will take over the entire host I/O workload within seconds and assume the role of primary controller.



Interfaces:



I²C port:

The I²C interface is designed for ISEMS (Infotrend Simple Enclosure Management Service). Firmware supports monitoring of remote enclosure devices (power, fan rotation speed, temperature, etc.). Via I²C interface, controller receives signals from remote sensors and sends events if the signals exceed thresholds. For more details, please refer to Infotrend's *ISEMS Implementation Guide*. The EonRAID 2000R series also supports S.E.S. through direct connection to enclosure device or through a Fibre drive.

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.

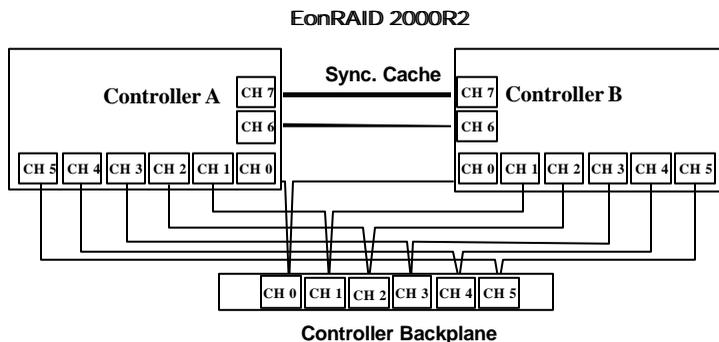
Serial Port:

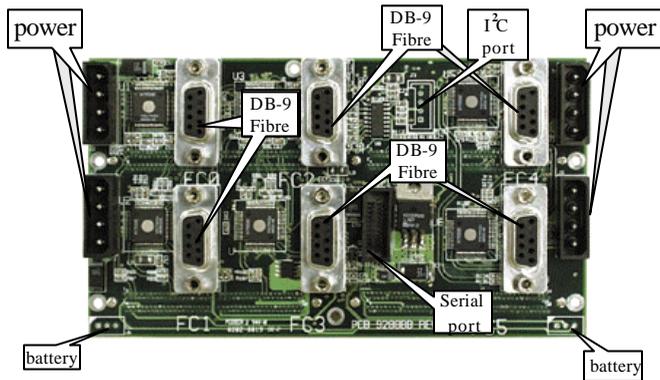
Use the included serial cable, IFT-9512, to connect to J2. This is the only serial port connector because only the primary controller responds to user's configuration in a redundant mode. If one controller should fail, the other will assume the role of the primary.

Channel Bus

Each of the controllers in 2000R2 configuration is installed with an expansion daughterboard. The IFT-9282FA adds another two Fibre channels and expands the number of Fibre channels to 6. Each controller in this configuration uses channels 6 and 7 as the communication channels. Fibre channel 0 to 5 can be used for host and drive. All channels can be configured as either host or drive. The default channels for host are 0 and 1. By-pass circuits have been implemented with every Fibre channel to maintain loop integrity.

The controller backplane integrates all signal paths and the communication (Fibre/SCSI channels) between controllers. The other interfaces are the same as those of the EonRAID 2000. Logical units can be assigned either to the primary or to the secondary controller via firmware configuration. Workload can thus be shared between I/O processors on the two controllers. In the event that one of the controllers fails, the other will take over the entire host I/O requests within seconds and assume the role of the primary controller regardless of its original configuration.





Other interfaces are the same as those on the IFT-9288BF.

5.3 Redundant Controller Operation:

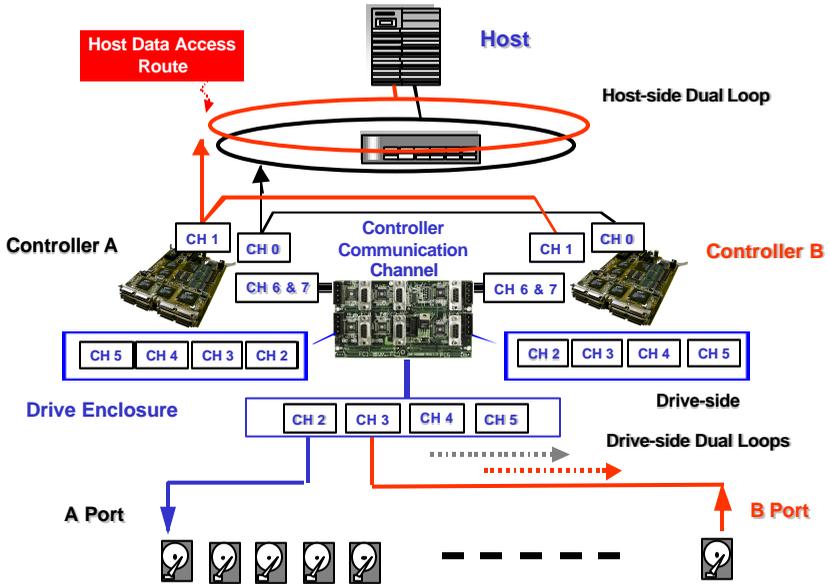
5.3.1 Hardware Requirement:

Requirements for redundant controller operation:

- Both controllers must have the same cache memory size.
- Both controllers must have the same firmware version installed.
- In redundant mode, the maximum number of disk drives on a drive channel is 124 and the maximum IDs for disk drives is 126.
- Host side ID mapping for Fibre operation will be determined by Fibre hub or switch.
- Both controllers should be installed with an independent battery module for data security with write-back cache operation. If not using battery modules, it is recommended that write-through cache operation be used instead.
- The EonRAID 2000 "R" series uses drive-side ID 119 and 120, thus they are unavailable for drive use.
- The EonRAID series supports active-to-active redundant controller operation. However, the Fibre chips only support a single loop ID. Active-to-active requires two HBAs on the host and two host channels configured with either a primary ID or a secondary ID.

5.3.2 Sample Configuration: EonRAID 2000R2

The figure below depicts the configuration of EonRAID 2000R2 with a single host. With the proper host-side driver, the host channels can be configured as redundant paths for extra redundancy.



| Controller/Host Channel | Status |
|-------------------------|---------|
| A/Fibre: channel 0 | Active |
| A/Fibre: channel 1 | Standby |
| B/Fibre: channel 0 | Standby |
| B/Fibre: channel 1 | Active |

Host LUN mapping decides the distribution of I/O traffic from host to drive. Perform the following actions to configure a redundant RAID system:

1. Create logical units from independent drives and assign these logical units to different controllers.
2. Designate host channel ID as primary or secondary. The logical units mapped to a primary ID will be served by the primary controller, and vice versa.

3. Simply attach a cable to host channel's DB-9 connector on the backplane. Every host bus runs through the controller backplane to the same host channel on both controllers.
4. Map different logical units to the primary or the secondary controller ID. The workload can then be shared between controllers. As shown in the diagram above, logical drives/volumes mapped to channel 0 will be managed by controller A and those mapped to channel 1 will be managed by controller B. It is presumed that channel 0 on controller A has been configured with a primary ID and channel 1 on controller B a secondary ID. When two controllers come online, the primary-secondary relationship will be determined logically by their serial numbers. The "primary ID" on channel 0 of controller A will be passed to channel 0 of controller B if controller A should fail. Since only one loop ID is supported on each host channel, set secondary ID to "NA" on channel 0 and primary ID to "NA" on channel 1.

The controller failover and fallback will be transparent to the host. Should one controller fail, the other will serve the I/Os originally destined to the failed one by bringing the "standby" channel to an active status. The once "standby" connection will become the "active" I/O channel. Cached writes will be completed for the cache data has already been synchronized between the two controllers.

The diagram can be viewed as a miniature of SAN environment. It shows a server and a disk array enclosure (the lower part of the diagram). The configuration provides better performance, data path redundancy, and controller fallback functions. The configuration has the following benefits:

1. The host accesses the array via two independent Fibre loops, each occupying a host channel. Accordingly, two host bus adapters should be used on the host platform. Separating the host access enables the host to perform at a broader bandwidth and an extra redundancy I/O path. Software support is necessary to direct I/O traffic from one adapter to another if any of the data path should fail.
2. Drives are configured in dual-loop configurations. Each dual-loop is comprised of two Fibre channels. As shown in the diagram, channel 2 and 3 are configured in a drive-side dual

loop, channel 4 and 5 another. Each dual loop can sustain failure of a single channel.

3. Dual-loop connection guarantees loop integrity should one of the two loops fail. During normal operation, controller automatically balances the I/O traffic between channels of a dual-loop. Receiving and transmitting data will then be running separately through the independent 100MB channels. Each dual-loop configuration will be operating at a 200MB/sec bandwidth.
4. When configured in a SAN environment, the configuration can be further expanded into a multiple of paths to more servers/resources using Fibre switch. The diagram above can be considered as one of the data resource in a Fabric network.

System Information

The working condition of a controller may easily be affected by different factors: system over heating, unstable voltage, and hardware failure. In addition to the overall environmental conditions within the enclosure, the controller is capable of self-monitoring. The SentinelRAID 150 continuously monitors different aspects of its working condition and automatically issue event message once an error occurs. Whenever the controller detects unstable or out-of-the-normal-range situations, a notification message will be sent to warn the system administrator.

There are different ways to notify a system administrator: on-board alarm, LCD display alert message, alert message on terminal emulation; and, if the Java-based GUI RAID manager is installed, a notification message can be sent remotely via email, pager, fax, or broadcast over LAN.

In this chapter, the discussion on controller environmental monitoring will focus on the access to this controller-embedded function through LCD display and terminal emulation. For more information on GUI RAID manager, please refer to the RAIDWatch's user manual.

The other remote devices status monitoring within the RAID enclosure (cooling fans, power supply, temperature status, etc.) requires the implementations of enclosure manufacturer.

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, your LCD should be displaying the message as follows:

```
SR2000    v.3.11F
Ready
```

The on-screen message should contain controller model number, firmware version, and current status of RAID configuration. “Ready” means there is at least one logical drive or any RAID configuration unit mapped to host LUN’s. If you have not configured your RAID system, LCD will be displaying “No host LUN.”

Press **ENT** for two seconds, no matter you have configured your RAID or not, 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 scroll down 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 the various voltage and temperature 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. Get into 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]**.

Cache Status: Clean

< Main Menu >

- Quick installation
- view and edit Logical drives
- view an
- s
- v
- v
- View
- Set
- Defi
- Adju
- Cont
- View

| ITEM | VALUE | STATUS |
|--------------------|----------|-------------------------------|
| ±3.3V | 3.384V | Operation Normally |
| +5V | 5.153V | Operation Normally |
| +12V | 12.199V | Operation Normally |
| CPU Temperature | 35.0 (C) | Temperature within Safe Range |
| Board1 Temperature | 56.0 (C) | Temperature within Safe Range |
| Board2 Temperature | 38.0 (C) | Temperature within Safe Range |
| Cooling FAN 0 | 6750 RPM | Operation Normally |
| Cooling FAN 1 | 7031 RPM | Operation Normally |

Voltage and Temperature Parameters

Arrow Keys:Move Cursor | Enter:Select | Esc:Exit | Ctrl+L:Refresh Screen

The current controller operation status will be displayed and defined as normal or out of the normal range.

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 the system error events can help different users to modify the tolerance range of the controller's self-monitoring function. A system administrator can decide to what extent the controller will be operating without receiving error message. Error message will only be sent when the controller detects the out-of-the-range conditions. Although the upper and lower thresholds can be modified, yet there is still a safety limit embedded in firmware on both thresholds. If the user enter an out-of-the-range parameter, an error message will prompt and the new parameter will be canceled. Under specific circumstances, for example, locations where the operating temperature is relatively high or low, pulling up and down the default threshold parameters on temperature can stop the controller from sending error messages unceasingly.

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↑," then press **ENT** to confirm.

```
View and Edit  
Peripheral Dev↑
```

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 Parms ..
```

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

```
Trigger Threshold  
Board Temp Event
```

Press ▼ or ▲ to select 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 another 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: □

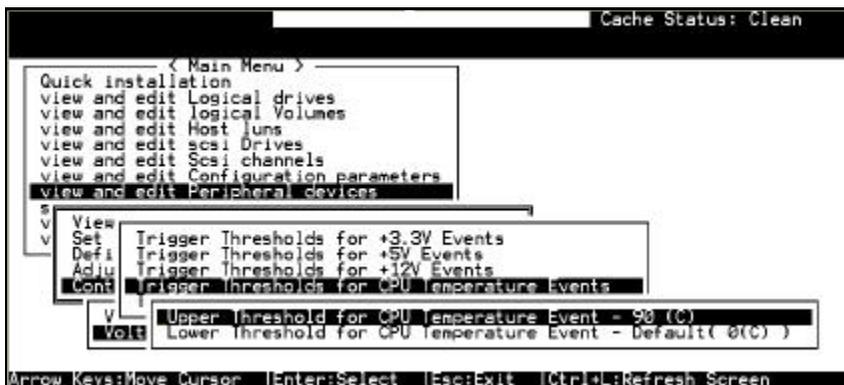
Follow the same method to modify other temperature or voltage parameters.

6.2.2 Via Terminal Emulation

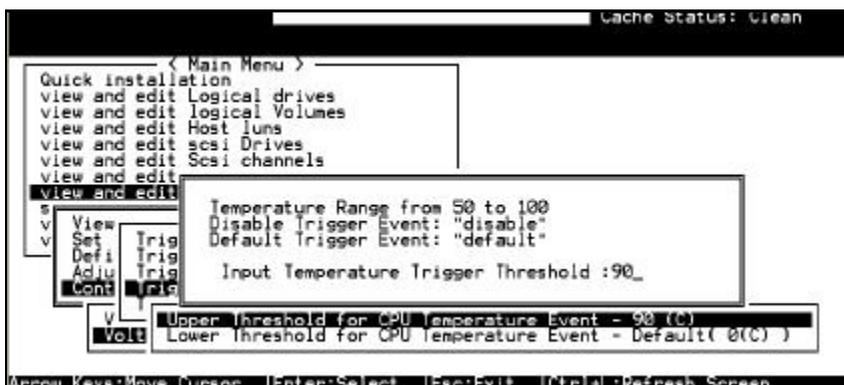
Open your PC Terminal Emulation screen. Get into the main menu and select “View and edit Peripheral devices.” Use the arrow keys to scroll down and select “Controller Peripheral Device Configuration,” “Voltage and Temperature Parameters,” and confirm by pressing **[ENTER]**.

```
Cache Status: Clean
< Main Menu >
Quick installation
view and edit Logical drives
view and edit Logical Volumes
view and edit Host luns
view and edit scsi Drives
view and edit Scsi channels
view and edit Configuration parameters
View and edit Peripheral devices
s
v
v
View
Set Trigger Thresholds for +3.3V Events
Defi Trigger Thresholds for +5V Events
Adju Trigger Thresholds for +12V Events
Cont Trigger Thresholds for CPU Temperature Events
    Trigger Thresholds for Board Temperature Events
v
Voltage and Temperature Parameters
Arrow Keys:Move Cursor |Enter:Select |Esc:Exit |Ctrl+L:Refresh Screen
```

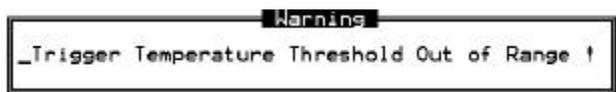
Scroll down and select an item to configure.



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. Any out-of-the-range value 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:

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.

```
View and Edit  
Peripheral Dev↑
```

```
Adjust LCD  
Contrast ..
```

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

```
LCD Contrast :  
■■■■■■-----
```

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 and leave.



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 activate on the next event.

Via LCD front panel:

From the main menu, select "System Functions \uparrow ." Press \blacktriangledown or \blacktriangle to select "Mute Beeper..," press **ENT** to proceed.

```
System Functions
  ↑
```

```
Mute Beeper
  ..
```

Press **ENT** to confirm.

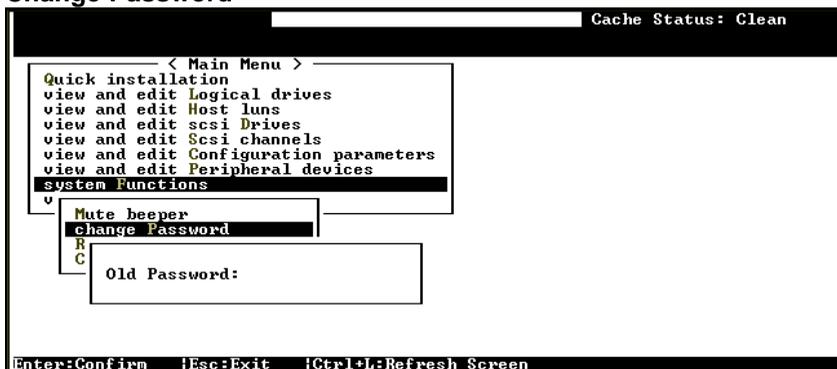
```
Mute Beeper
  ?
```

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 RAIDWatch 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 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

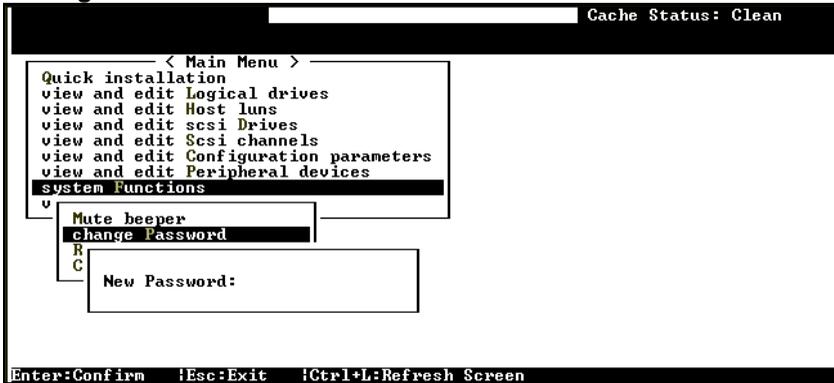
To set or change the controller password, move the cursor bar to "Change Password", then press **[ENTER]**.

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 correct, 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.

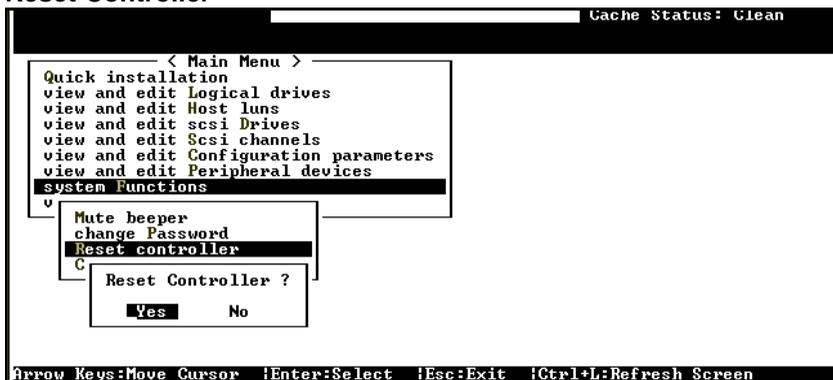
Setting the Password Validation Timeout

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.

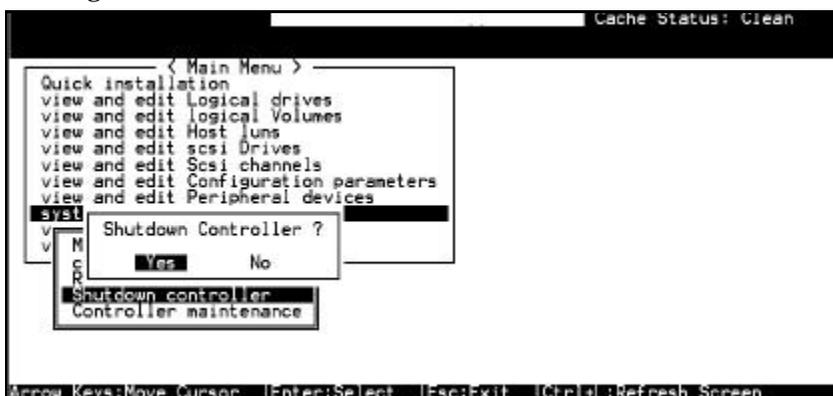
Reset Controller



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 or power-off.

Shutdown Controller

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



For downloading firmware functions, please refer to *Generic Operation manual* Appendix C.

Appendix A

Controller Hardware Specifications

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 |
| Fibre channels | 4 on base module for EonRAID 2000-4 and EonRAID 2000-6 |
| SCSI channels | 2 on base module for synchronized cache connection in redundant controller mode; EonRAID 2000-6 uses a backplane which provides 6 DB-9 Fibre connectors but can not use external SCSI connection for cache synchronization. |
| Host interface | FC-AL Fibre (2 on optional daughterboard, IFT-9282FA) |
| Host channels | 4/2 (with daughterboard) |
| Drive interface | Fibre (base module) Fibre (optional daughterboard) |
| Drive channels | Up to 5/6, EonRAID 2000-6 with optional daughterboard |
| Maximum number of drives | Up to 625 (with optional daughterboard) |
| Cache memory size | 32MB 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 ID's per host channel | Yes |
| Firmware on Flash memory | Yes |

| | |
|---------------------|--|
| Drive hot-swap | Yes |
| Controller hot-swap | 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 SCSI controller |
| Fibre controllers | Qlogic ISP2200 Fibre controller |
| DIMM slot | one 168-pin DIMM module |
| PC-100 support | Yes |
| ASIC | Infortrend 64-bit chipset |
| Flash RAM | 16Mbit (2 MB) |
| NVRAM | 32KB |
| Hardware XOR | Yes |
| I/O channel bandwidth | Fibre: up to 100 Mbytes/sec, single loop |



IMPORTANT:

Infortrend RAID controllers use a convection-cooled processor. An airflow across the chipset heat sinks is very important for operation within the normal temperature range.

A.3 RAID Management

| Specification | Feature |
|-------------------------------|---|
| SNMP agent support | Yes (Windows NT 3.5/4.x, Windows 2000, Windows NT 4.0 for DEC Alpha, Novell NetWare 3.1x/4.x/5.x, SCO UnixWare 2.1x/7, SCO OpenServer 5.0x, Sun Solaris 2.5.x/2.6/2.7/7 [x86 and SPARC], Linux) |
| Performance monitoring | Yes |
| Remote control and monitoring | Yes |
| Event broadcast/alert | Yes |
| Hardware connection | In-band SCSI, In-band Fibre, or RS-232C |
| Failure indicator | Via buzzer, front panel, RAIDWatch GUI manager notification, 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 |
| S.E.S., SAF-TE 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 | Yes |
|--|-----|

| | |
|---------------------------|---|
| in a RAID 0 logical drive | |
| 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 Java Applet running on Web browser) |
| LAN/WAN support via SNMP | Yes |

A.6 Controller Specifications

| Specification | Feature |
|--|---|
| Controller size (in frame) | Form Factors: 9.93L x 5.75W x 1.60H inches –half-height Form Factors: 9.93L x 5.75W x 3.30H inches - full-height |
| Main board size (without backplane) | 7.99L x 5.62W inches |
| Main board height with daughterboard | 1.19" |
| CPU | PowerPC® 750 microprocessor |
| Cache memory | 32MB to 1GB, SDRAM DIMM socket x1 with ECC support |
| Firmware | 2MB Flash memory |
| NVRAM | 32KB |
| Operating voltage | Controller Main board Model Voltage Peak EonRAID 2000-4 5V peak 5A, 12V peak 0.4A EonRAID 2000-6 5V peak 5.8A, 12V peak 0.4A EonRAID 2000R1 5V peak 11.7A, 12V peak 0.4A EonRAID 2000R2 5V peak 13.3A, 12V peak 0.4A |
| Operating temperature | 4 to 44°C |
| Operating ambient temperature within the enclosure | <50°C |
| Relative humidity | 10 to 96%, non-condensing |
| Operating altitude | Sea level to 10,000 ft |
| MTBF | Greater than 500,000 hours |
| Devices per channel | Fibre: up to 125 devices |
| Supported device types | Synchronous or asynchronous |
| RAID levels supported | 0, 1(0+1), 3, 5, 10, 30, 50, JBOD and non-RAID disk spanning |
| Fibre connectors | copper DB-9 |
| Fibre cables | Full duplex send/receive payload buffers cable lengths: 30m (copper), 10km (optical) |
| SCSI connectors | 68-pin high-density connectors (x 2) |

| | |
|-------------------------------|---|
| 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 controller backplane, integrating Fibre/SCSI channels, redundant controller features, RS-232C COM-1 and COM-2, battery connector signal, external LED's, buzzer, external LCD module, S.E.S. status inputs, I ² C port and drive failure indication interface |

Hardware Troubleshooting

We provide a list of the common problems you may encounter during or after hardware installation.

| <u>PROBLEM</u> | <u>CHECK</u> |
|--|--|
| LCD is off | <ol style="list-style-type: none"> 1. Check power connections to the controller backplane and LCD panel. 2. Requires a minimum of 32 MB SDRAM DIMM installed. |
| Fibre channel failure detected upon start-up (Fibre cables connected) Message on LCD: <div style="border: 1px solid black; padding: 2px; width: fit-content;"> Fibre CHLs fail CHL=x, x, x </div> | <ol style="list-style-type: none"> 1. Check ID numbers (must be unique for each device on the same Fibre channel). 2. Check the voltage output of the power supply, please refer to chapter 4 for details. |
| Initialization failure | <ol style="list-style-type: none"> 1. Check ID numbers (must be unique for each device on the same channel). |
| Cannot detect drive | <ol style="list-style-type: none"> 1. Check drive power connections. 2. Check drive Fibre/SCSI cable connections. 3. Check ID numbers (must be unique for each device on the same channel). |
| Host cannot detect EonRAID 2000 | <ol style="list-style-type: none"> 1. Check host cable connections. 2. Check Fibre port to LUN assignment. 3. Check logical drive mapping to LUN's. |
| Parity error detected | <ol style="list-style-type: none"> 1. SDRAM DIMM should be replaced. |

| | |
|---|---|
| Logical drive failure detected during boot-up | <ol style="list-style-type: none"> 1. Check if the installation of controller or connection of the drives (use the "View and Edit SCSI Drives" function to help locate the problem). |
| System is not stable after running for a period of time. | <ol style="list-style-type: none"> 1. Fibre/SCSI cable length must be within the range of specifications. 2. If using SCSI, make sure SCSI terminators are properly installed. 3. Power supply voltage must be within specification, please refer to chapter 4 for details. 4. Check the enclosure's inner temperature. |
| 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 through firmware configuration via LCD panel: "View and Edit Configuration Parameters," → "Communication Parameters," → "RS-232 Port Configuration," → "COM1 Configuration," → "Terminal Emulation Enabled." 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. |
| The logical drive states "INVALID" | <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 appears as only “40Mhz”, not “80Mhz” or higher</p> | <ol style="list-style-type: none"> 1. “40Mhz” is SCSI/Fibre sync frequency, not transfer rate. |
| <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 10 of your “Generic Operation Manual” for future reference. 2. Use "Save NVRAM" function. |
| <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 11 Redundant Controller” in your “<i>Generic Operation Manual</i>” for more details. |
| <p>Having trouble when spinning up multiple drives connected to the controller using the same power supply. Spinning up all drives all at one causes problem.</p> | <p>Please refer to <i>Generic Operation Manual</i> version 1.2 or access the firmware function “View and Edit Configuration Parameters”/Drive-side Parameters”/”SCSI Motro Spin up” via terminal emulation or LCD control.</p> |
| <p>Error: Check DRAM Installed?</p> | <ol style="list-style-type: none"> 1. Check to see if a DIMM module is installed or properly installed. |
| <p>ER2000 v3.11F No Host LUN</p> | <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> |

| | |
|--------------------------------|--|
| <p>ER2000 v3.11F Ready</p> | <p>This is a normal message when a logical drive has been created and mapped to a host channel ID/LUN.</p> |
| <p>[Other error messages]</p> | <p>Please refer to the "Appendix D" of your <i>Generic Operation Manual</i> or contact your vendor for assistance with any other error messages.</p> |

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 |
| 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 Fibre cable for the IFT-9282FA (daughterboard with Fibre channels) is as follows:

| Electrical | |
|-------------------|-------------------------|
| Material | Copper |
| Maximum Length | 30m between each device |
| Impedance | 150Ω |
| Connector Type | DB-9 passive, female |
| 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 |
| Fibre (copper cable) | - | - | - | 30m | 126 |
| Fibre (fibre-optic cable) | - | - | - | 10km | 126 |

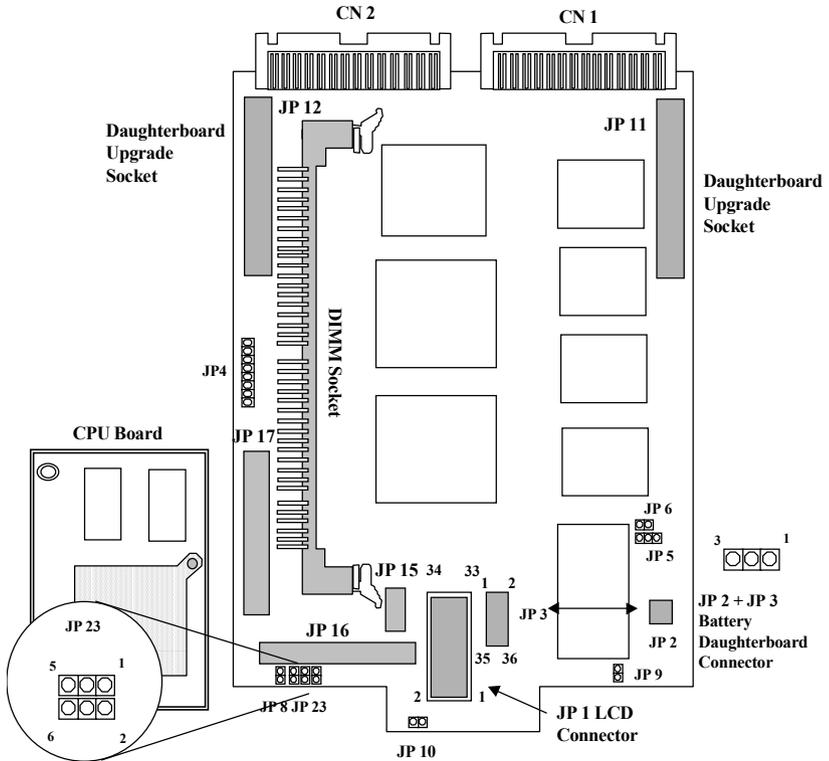
SCSI Bus Width and Maximum Throughput

| | 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 |

Fibre Bus Width and Maximum Throughput

| | Bus Width | SCSI Bus Sync. Frequency | Max. Bus Throughput |
|-------|------------------|---------------------------------|----------------------------|
| Fibre | 1-bit | 1 GHz | 100 MB/Sec |

Connector and Jumper Identification



Controller Main Board Diagram

| Connector | Description |
|-------------|---|
| JP 1 | LCD Connector |
| JP 2 | Battery Daughterboard Connector |
| JP 3 | Battery Daughterboard Connector |
| JP 4 | Reserved |
| JP 5 | Loop back test (Enable: 2-3 short, normal: 1-2 short) |
| JP 6 | Front panel fan status detect (disable: 2-3 short) |
| JP 8 | LCD type selection (4-line: short; 2-line: open) |

| | |
|----------------------------------|--|
| Continued from the previous page | |
| JP 9 | NMI - non mask interrupt (Enable: short) |
| JP 10 | Reset (Enable: short) |
| JP 11 | Daughterboard Upgrade Socket |
| JP 12 | Daughterboard Upgrade Socket |
| JP 15 | CPU Board Socket |
| JP 16 | CPU Board Socket |
| JP 17 | CPU Board Socket |
| JP 23 | LED connector |
| CN1 | Main Board to Backplane Connector |
| CN2 | Main Board to Backplane Connector |

JP 23 LED connector pinouts

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

JP 23 is an alternate LED connector for OEM.

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:

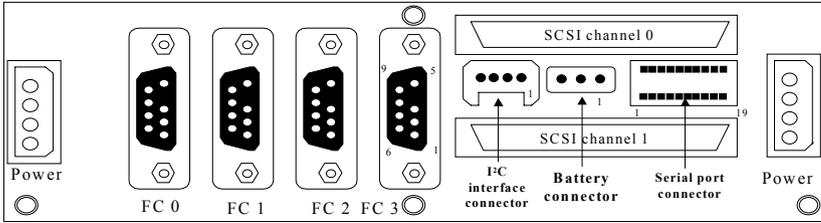
Pinout Description

| 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 |
| V12V | P | +12V voltage input |
| N/C | - | No connection |

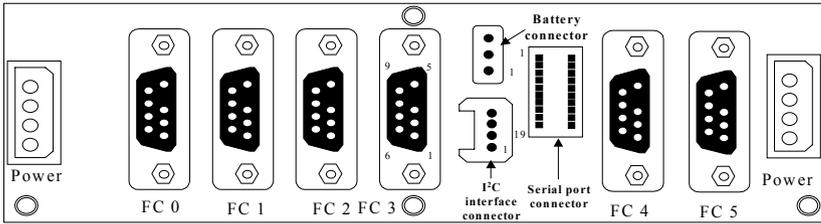
TTL Device Parameters

| Symbol | Parameter | Rating | Unit |
|-----------|--|--------------------|------|
| V_{IN} | Input voltage | -0.5 to +7.0 | V |
| I_{IN} | Input current | -30 to +5 | mA |
| V_{OUT} | Voltage applied to output in High output state | -0.5 to + V_{CC} | V |
| I_{OUT} | Current applied to output in Low output state | 40 | mA |

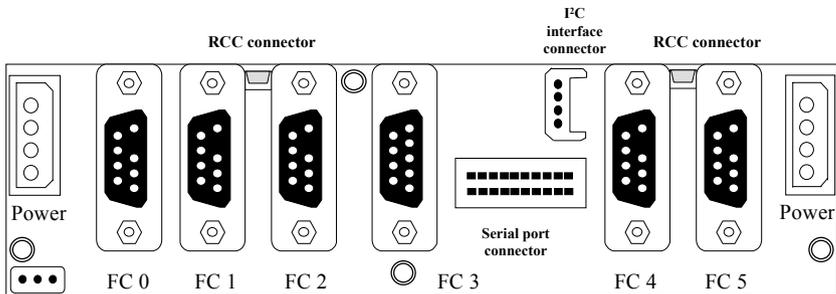
Controller Backplane Diagram



IFT-9288B6A



IFT-9288B6B



Battery connector

IFT-9288B6B Phase II model: This backplane upgrade is exclusively designed for redundant controller configuration using Fibre channels as the communications paths. Inter-controller communications over Fibre loops is supported with firmware release 3.14 and above.

4-pin Redundant Controller Cable Pinouts

| | |
|-------------|--|
| Pin1 | Detect Out: Hot swap detect output to another controller |
| Pin2 | GND: Ground |
| Pin3 | Reset In/Out: Reset signal input from another controller |
| Pin4 | Detect In: Hot swap detect input from another controller |

DB-9 copper male header pinouts:

| Pin | Symbol | Description |
|-----|---------|----------------------|
| 1 | FC0_TXP | Transmitter positive |
| 2 | VCC | MIA power (5V) |
| 3 | NC | N/C |
| 4 | NC | N/C (key blocked) |
| 5 | FC0_RXP | Receiver positive |
| 6 | FC0_TXN | Transmitter negative |
| 7 | GND | GND |
| 8 | GND | GND |
| 9 | FC0_RXN | Receiver negative |

Serial Port: COM 1 and COM 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 (currently not in use) |

I²C Port

I²C Port Pinouts

| Pin | Pin name |
|-----|-----------------------|
| 1 | I ² CCLK |
| 2 | GND |
| 3 | VCC |
| 4 | I ² C DATA |

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 |

Battery Connector

Battery Connector Pinouts (JP-4)

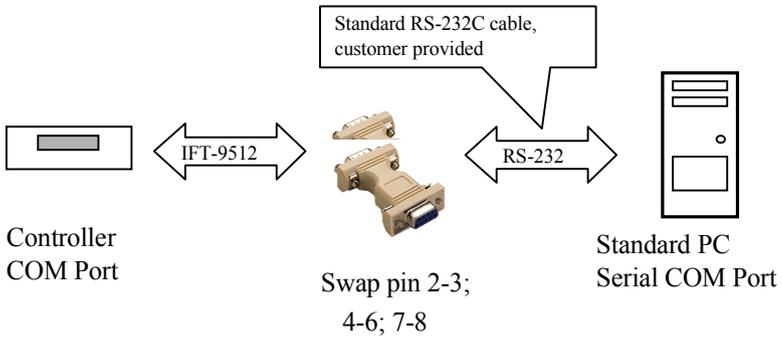
| Pin | Pin name |
|-----|----------|
| 1 | VBAT_P |
| 2 | VBAT_THM |
| 3 | VBAT_N |

Battery Connector Description:

Battery Connector Pinout Description

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

Using Null Modem:



Null Modem Pinouts:

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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