SentinelRAID 100

Ultra2-to-Ultra2 SCSI RAID Controller

Hardware Manual

Revision: 1.2

Infortrend®

Table of Contents

About This Manual

This manual provides the necessary information a system administrator with experience in SCSI and RAID technologies needs to install and/or upgrade the SentinelRAID 100 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 new product versions. This manual (v. 1.1) is fit for the operation with SentinelRAID 100 of the following hardware and firmware version:

PCB Version: 1.0 or above
PCBA Version: 1A or above
Firmware Version: 3.11F or above
Part No. for this manual: M3202UKH12

Related Publications

Other manuals that may be necessary during installation include:

- RAIDWatch manager User's Guide

- Other manuals for SCSI drives, host system, enclosure, and other components

Revision History

5/20/'00 Initial release 1.1
5/25/'00 Version 1.2 official printing
        Corrected SCSI synchronous clock

Introduction

Thank you for purchasing the SentinelRAID 100.

The SentinelRAID 100 is an Ultra2-to-Ultra2 RAID controller specifically designed to provide RAID 0, 1(0+1), 3, 5 or JBOD capability to any host system equipped with a SCSI 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 an IBM PowerPC® RISC CPU with high-speed SDRAM's and firmware in flash memory. In effect, it endows the host system with high-speed and fault-tolerant disk storage operation using RAID technology. It is an ideal solution for weaving several hard disks into one contiguous volume.

The controller has comprehensive drive failure management that allows automatic reassignment of reserved blocks when a bad sector is encountered during a write. Hot swapping 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 spare drive operation. What's 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.

SentinelRAID 100 provides four Ultra2 Wide LVDs as base channels. Unlike other SentinelRAIDs, it does not support optional daughterboard upgrade. With all the channels configurable as either host or drive, the four Ultra2 SCSI channels will meet the needs of most system integration.

Standard Package Content

- SentinelRAID 100 RAID controller
- A CD title for drivers and utilities
- Generic Operation Manual
- This hardware manual
- IFT-9016 serial cable
- IFT-9011 Null Modem

The controller battery backup module is an optional item. SDRAM module will not be included in kit.

Chapter 1 Quick Installation

Front Panel (LCD)
SentinelRAID 100
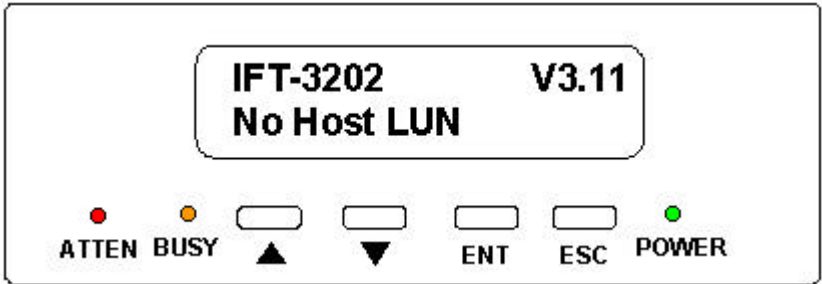
Key:

[**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)
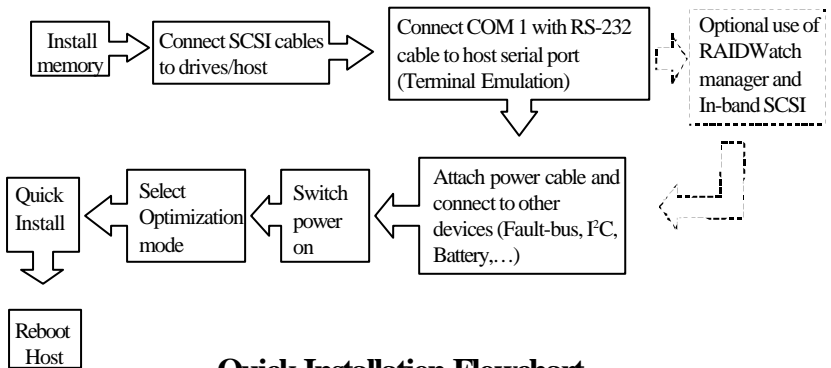
Quick Installation Flowchart

Hardware installation details will be discussed in the following chapters.

Optimization for Random or Sequential I/O

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

1. After adding memory , power on the controller. The LCD should read, "IFT-3202 V3.11F NO HOST LUN"

2. [**ENT**] for two seconds to "Quick Logical Drive Install ↓"

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

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

    RAID 5 + Spare
    RAID 5
    RAID 3 + Spare
    RAID 3
    RAID 1 + Spare
    RAID 1
    RAID 0
    NRAID

5. [**ENT**] to select an option, for example, "RAID5+Spare"

6. LCD screen will read "Init Parity 24% Please Wait !" The percentage of initialization progress will be shown, front panel BUSY LED and enclosure hard disk busy LED(s) will be lighted. Note that the time it takes to initialize varies by selecting different RAID levels. Drive capacity and drive speed are also parameters of controller performance.

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

8. [**ESC**] three times to main screen, "IFT-3202 v3.11F READY"

> **NOTE**:
>
> *1. You may need to reboot your Host to "see" or negotiate with the controller. When SCSI negotiation is complete, you will be able to partition and/or format the RAID. Once you have written data to*

the controller the front panel will no longer display the "READY" text on the second line.

2. IFT-3202 is the model number of SentinelRAID 100. The LCD will display IFT-3202; or, you may setup a controller name to be displayed on LCD. Please refer to your Generic Operation Manual for details.

Chapter 2   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 spanning
RAID 30	Logical volume with RAID 3 logical drives spanning
RAID 50	Logical volume with RAID 5 logical drives spanning

✓ Comprehensive failure management including:
- Automatic bad block reassignment
- Drive hot swapping
- Spare drive operation (supports both Global Spare and Local Spare)
- Background and concurrent 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
- Works with any operating system without additional software drivers

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

✓ Up to seven drive channels for a total of 45 connected drives (SCSI operation)

✓ Supports up to 15 SCSI ID's per channel

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

- ✓ Up to 8 partitions per logical drive; a total of 64 partitions are supported
- ✓ Controller, logical drive and logical volume can be assigned a name for ease of identification
- ✓ Number of drives for each logical drive: 31 (RAID 3 or 5); 45 (RAID 0 or NRAID); 44 (RAID 1)
- ✓ Dynamic mapping of LUN's to logical drives. Two or more LUN's can be mapped to the same logical drive for redundant host operation
- ✓ Concurrent/background logical drive initialization
- ✓ Performance optimization for either sequential or random I/O
- ✓ Allows multiple drive failure and concurrent multiple drive rebuild of a RAID (0+1) logical drive
- ✓ Configuration of individual SCSI target parameters
- ✓ Prior to first disk access, it allows adjustment of delay time during controller initialization to enhance compatibility with slow-initial drives
- ✓ All channels are Ultra2 SCSI (backward compatible to SCSI-1) and can be configured as either a host or drive interface
- ✓ Two or more SCSI channels can be simultaneously set as host interface for redundant host system operation
- ✓ Compatible and will automatically match any SCSI hard disks with SCSI-1, SCSI-2 or (Ultra)-Wide-SCSI (1 or 2) specification
- ✓ Full SCSI implementation including Tagged Command Queuing and Multi-Threaded I/O
- ✓ Uses PowerPC® RISC CPU with all executable firmware downloaded into high-speed SDRAM
- ✓ SDRAM DIMM supports ECC function
- ✓ Up to 1GB of intelligent Read-ahead/Write-back cache
- ✓ Firmware resides in easy-to-update flash memory
- ✓ Write-through, write-back, Multi-threaded intelligent predictive read-ahead, optimized sorted grouped writes
- ✓ Front panel LCD and push-buttons for configuration and message display
- ✓ Supports TELNET with PPP protocol for remote administration

- ✓ RAIDWatch manager and RS-232C terminal interface for RAID management
- ✓ SAF-TE support
- ✓ Supports ISEMS via I^{2}C interface for enclosure management (ISEMS: Infortrend Simple Enclosure Management Service)
- ✓ In-band Text RAID Manager provided for configuration through SCSI/Fibre rather than RS-232C
- ✓ TCP/IP agents provided for remote administration via RAIDWatch manager or SNMP trap event monitoring with third-party SNMP software
- ✓ Active-to-active redundant controller configuration via SCSI synchronized cache connection
- ✓ Controller self-monitoring features: monitors the voltages (+5 and +12), temperature (CPU, ASIC, board) and fan rotation speed status (front panel fans)
- ✓ Dual power connector design: to avoid single point of failure on the power connector and also guarantees a more efficient power source
- ✓ Supports 168-pin PC-100 standard SDRAM module. Buffered, unbuffered, ECC, non-ECC, registered, and non-registered modules are supported

Chapter 3 Hardware Introduction

3.1 Steps for the Hardware Installation:

1. Follow the instructions, Notes, and Warnings in this manual.
2. Turn off all power to the host and all hard disk drives, enclosure, and other components.
3. Check if all the SCSI components (cable type, cable length, terminators, and ID setting) you use meet the SCSI convention. Please refer to Appendix C for details.
4. Install cache memory. Please refer to Chapter 4..
5. Install the controller in the server/enclosure and attach the SCSI/Fibre/serial cables and terminators as needed. If using on-board terminators for SCSI termination, please refer to section 4..6 to shunt the terminator jumpers properly.
6. Make sure all cables are correctly attached in accordance with SCSI rules. Make sure the controller is properly installed. Turn power on after all components are correctly installed.
7. Install the controller software utilities (in-band SCSI) or RAIDWatch manager.
8. Configure and initialize your RAID.

Notice for Unpacking:

☞ Provide a static free environment to unpack before installing the controller components. The controller is packed inside an anti-static bag and carbon buffers. Remove the controller carefully and inspect if it is damaged. If the controller appears damaged, please contact Infortrend for assistance.

3.2 Locations of the Parts
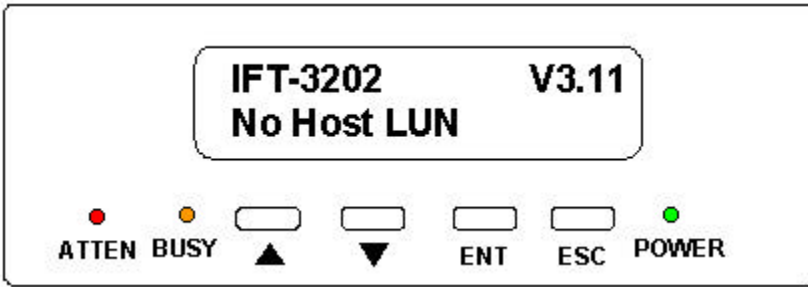
Front View

3.2.1 LCD Panel

POWER	Lighted LED indicates 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 selection.
2 x 16 LCD	Displays throughput during normal operation, approximately 256Kbytes/sec per division. Displays message for configuration and management.

3.2.2 Mounting Holes:

The controller can be installed into any industry standard 5.25" half-height canister. To secure the controller within an enclosure chassis, drive screws through the enclosure's mounting rails and into the eight 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 electric shorting inside the controller.
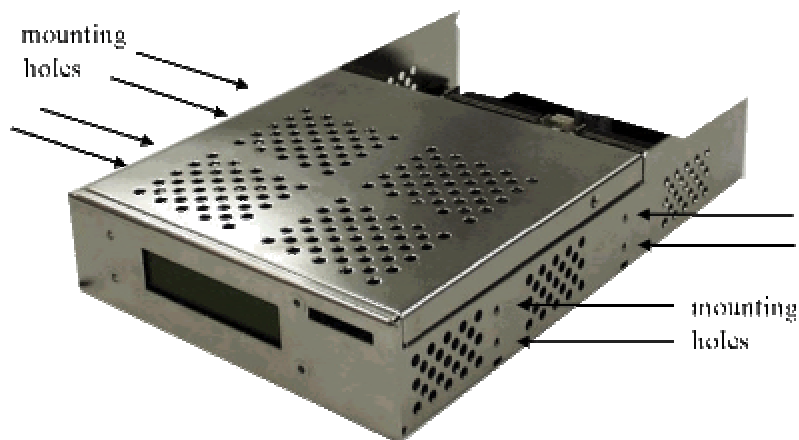
3.2.3 The Controller Main Board
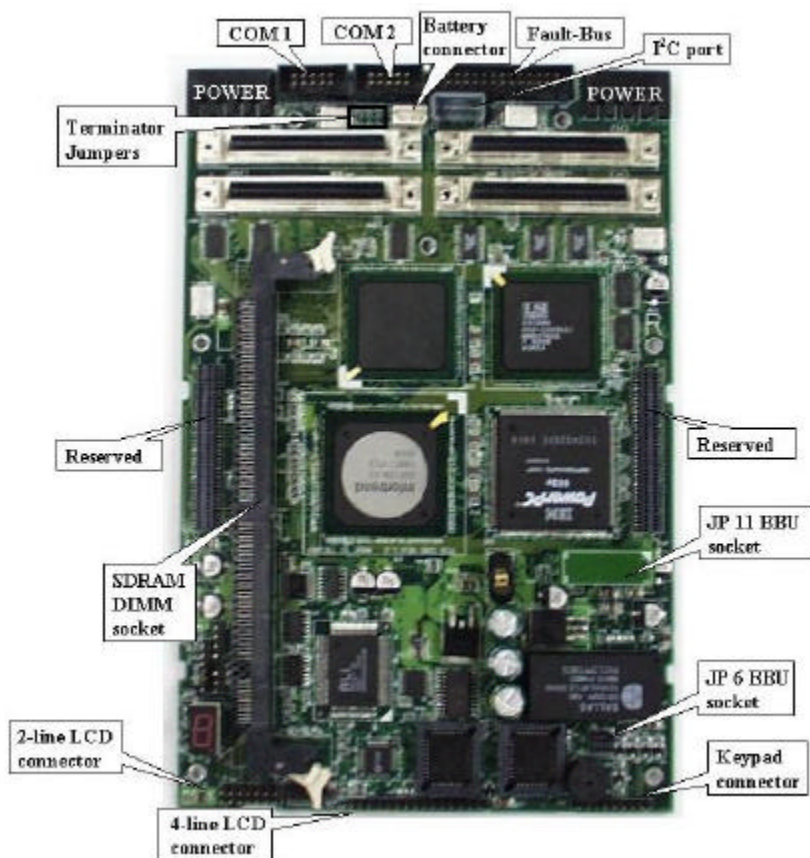
3.2.4 Accessories

Battery Module: optional

Optional battery backup board
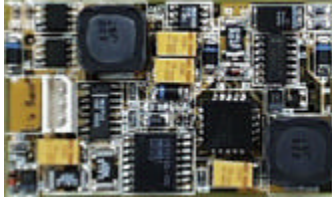
IFT-9070C
(Battery backup daughterboard for SentinelRAID 100)

IFT-9010C
(Battery cell pack module for SentinelRAID 100)

Cables: included in kit

IFT-9016
(Y-cable for Serial COM 1 and COM 2)

IFT-9011
(Null Modem)

Chapter 4 Hardware Installation

4.1 Removing Controller Top Cover

1. Unpack the controller carefully from its package; or, if you are upgrading controller memory, turn off all power to the server or RAID enclosure. If you are installing memory to a new controller, jump to step 3.

2. After you turn off the controller power and unplug the power cords, remove the controller from the enclosure cabinet or chassis where it is located.

3. Locate and unscrew the two fasteners on the sides of controller. Remove the controller top cover by sliding the top cover backward and upward to remove it.

4. With controller front panel and top cover removed, you may continue with installing hardware components.

WARNING:

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

4.2 Installing/Upgrading SDRAM DIMM's

☞ **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 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.

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

How to Install/Upgrade SDRAM DIMM's

☞ **IMPORTANT:**
The SentinelRAID 100 controller requires a minimum of 32 Mbytes SDRAM DIMM (with or without parity function) installed in the DIMM socket in order for it to operate. The controller is normally delivered without any SDRAM installed.

The following are guidelines on using SDRAMs:

- ✓ Use 168-pin SDRAM DIMM module (buffered/unbuffered DIMM are supported). SDRAM DIMM's that meet 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.
- ✓ The minimum SDRAM required is 32Mbytes installed in a DIMM socket, however, greater memory size is recommended.
- ✓ The controller supports between 32MB and up to 1GB SDRAM DIMM modules.

To install the SDRAM DIMM:

1. Before installation, make sure that there is no power connected to the controller and anti-static discharge methods have been applied. Before installation, you have to remove controller main board or the chassis top cover. Please refer to section 4.1 for details on removing controller top cover.

2. Remove daughterboard and battery module before installing or replacing DIMM's.

3. Pull the tabs at the ends of the DIMM socket aside.

4. Position the DIMM toward the socket with the notches in the module aligned with the keys on the socket.

5. Insert the module horizontally into the socket. The tabs will hold the DIMM in place.

Controller Boar

1. Pull tabs

2. Install

1. Pull tabs
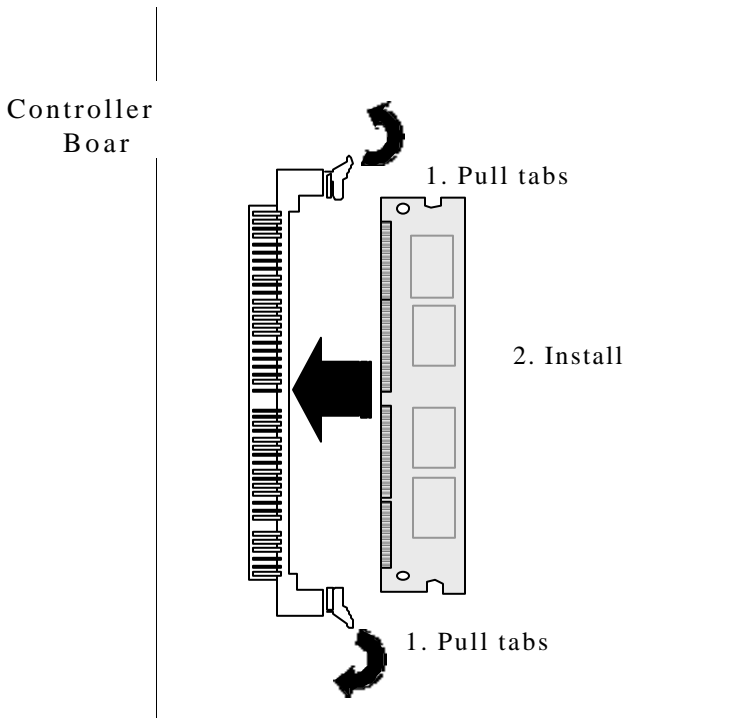
4.3 Power Connection

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.
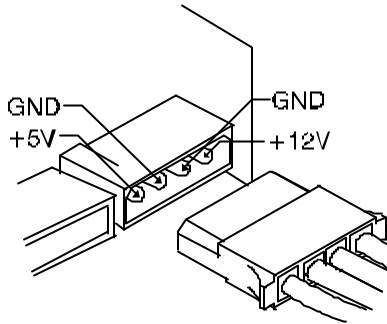
4.4 How to Connect RS-232C Terminal Emulation

The SentinelRAID 100 controller can be configured via a PC running a VT-100 terminal emulation program, or a VT-100 compatible terminal. The provided RS-232 cable (IFT-9016) receives the RS-232 signals from the 10-pin header on the controller and ends with a 9-pin D-Sub male connector. 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 illustration. Connect COM 1 to the included Null Modem (IFT-9011) and connect the other end of the Null Modem to the outside of your enclosure or to an external RS-232 cable. COM 1 and COM 2 can also be used for a direct connection to a modem. For SentinelRAID series, COM 2 should not be used for connecting to another controller in redundant controller mode.
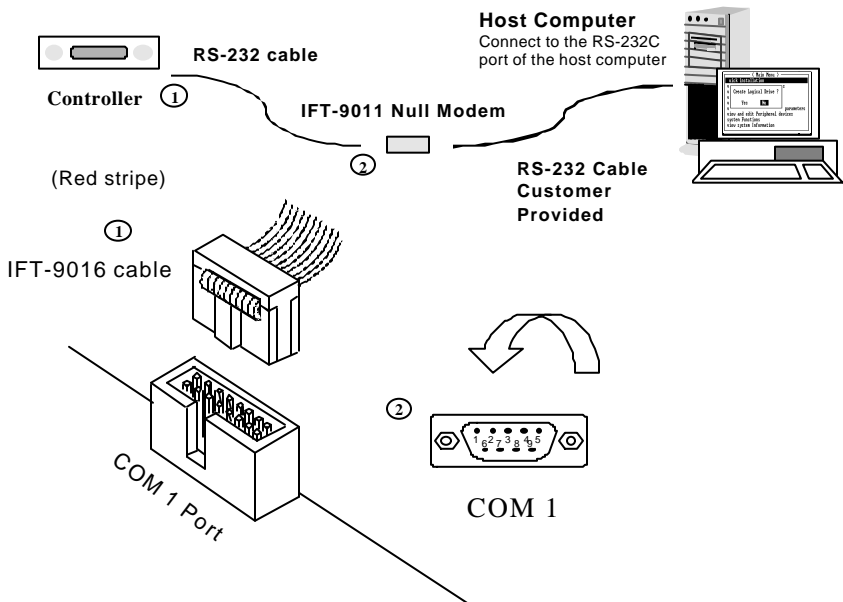
The following are guidelines on using the serial port:

- The serial port's default is set at 38400 baud, 8 bit, 1 stop bit and no parity.

- In most cases, connecting RD, TD, and SG 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

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", then press **ENT**.

```
View and Edit
Config Parms    ↕
```

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

```
Communication
Parameters     ..
```

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

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

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

```
COM1
Configuration ..
```

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

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

Press ▼ or ▲ to select the baud rate, then press **ENT** for 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 on the terminal must be identical.

4.5 How to Enable/Disable On-Board Terminators
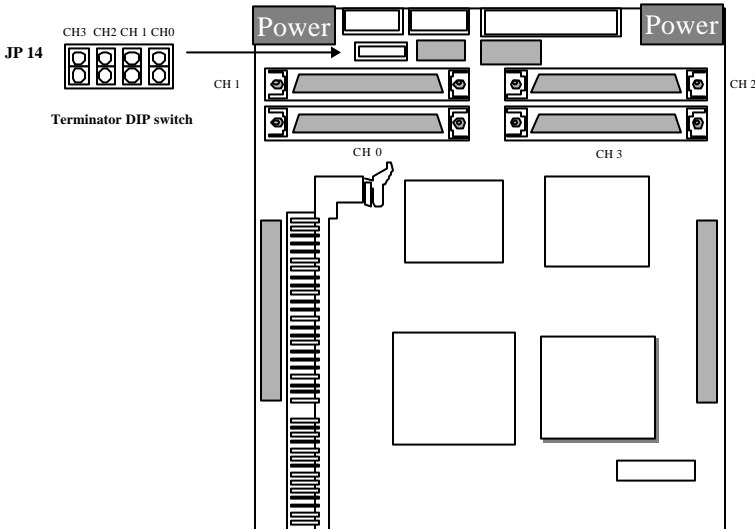
Terminator Jumpers on Controller Main Board

1. To enable the SCSI termination on the associated SCSI channels:

   - You may choose to shunt the terminator jumpers (JP 14) on controller main board as shown in the diagram above.

     - OR -

   - You may also configure (either using front panel or terminal emulation) the associated channel as "terminator enabled" or "terminator disabled." When the terminator jumpers are shunted, the associated SCSI channels will be terminated on the controller side no matter firmware setting is terminator "enabled" or "disabled." Remember to terminate the other end of the SCSI cable with an external terminator and to disable terminators on all SCSI drives.

2. To disable SCSI termination on the associated SCSI channels:

   - Leave the terminator jumpers of the associated channels open. The firmware setting of the associated SCSI channels must also be configured as "terminator disabled." Configure SCSI termination in "Main Menu"/View and Edit SCSI Channels"/"SCSI Terminator."

3. When finished with hardware installation, you may refer to Infortrend's *Generic Operation Manual* for instructions on how to configure your RAID system.   If your controller initializes successfully after the installation, you will be able to start "View and Edit SCSI Channel" function to see if your SCSI channels are correctly recognized by your controller.

4.6 How to Install/Replace Battery Backup Module

The SentinelRAID 100 controller operates using cache memory. However, if the controller is configured as write-back cache enabled and a power failure occurs, the cache memory may contain buffered data that has not been written to the hard disks. This buffered data is not retrievable when power returns unless a back-up power is provided. The combination of the IFT-9070C and IFT-9010C allows two battery packs to be daisy-chained for longer back-up time and can sustain power supply longer than 72 hours.

Each battery in the cell pack has a storage capacity of 3A/H when fully charged, and three cells are used for a total of 3.6V source. The charger circuit on IFT-9070C provides a 160mA charge until: 1. a time limit of 90 minutes is reached; 2. a temperature limit of 60 C is reached. After the fast charging, the charger will shift to a trickle stage until the charge is full.

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

The combination of the IFT-9070C daughterboard and IFT-9010C battery cell pack provides up to 72 hours of back-up 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 battery cell pack that connects to the battery connector located on the main board. Two IFT-9010C's can be daisy-chained to provide long hours of cache memory back-up over a period of days.

☞ **WARNING:**
Do not attempt to install, remove, or upgrade a SDRAM DIMM on the SentinelRAID 100 with the battery installed. Damage to the controller components will occur.

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

1. Make sure all power connections to the controller and drives are turned off. Provide a static-free environment in your working area.
2. Remove the controller from the enclosure and remove the controller top cover (refer to section 4.1).
3. Locate the BBU socket plug that is inserted in the female pin socket JP 11 (refer to the main board diagram in Chapter 3).

JP 11 Socket Plug

JP 11

JP 6

Controller Main Board
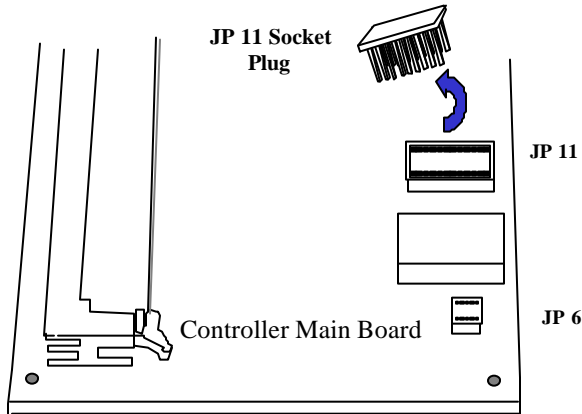
4. Remove the socket plug that is on JP 11 (keep the socket plug in a safe place for future use). Pin socket JP 11 must be installed with either the socket plug or the battery backup daughterboard.

IFT-9070C Battery Daughterboard

JP 11

JP 6

Controller Main Board
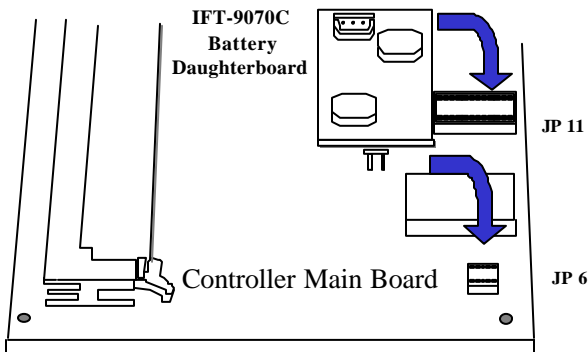
5. Now install the IFT-9070C battery backup daughterboard onto the controller main board.

6. There are two alternatives for installing IFT-9070C battery daughterboard and IFT-9010C battery cell pack:

   The first is, install IFT-9070C to controller main board and connect IFT-9010C to the 3-pin battery connector (J 2) on controller main board.

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

☞ **IMPORTANT:**

Be careful to properly insert the pins on the IFT-9070C daughterboard. All of the pins should be seated in the female pin sockets JP11 and JP6. Failure to properly insert the pins may result in damage to the controller.

7. Connect the IFT-9010C cell pack to the battery connector located on the controller main board (J 2) as shown above; or, if there is enough room in controller canister, connect the IFT-9010C cell pack directly to IFT-9070C battery daughterboard as shown below. Either of the linking cables on IFT-9010C can be used.
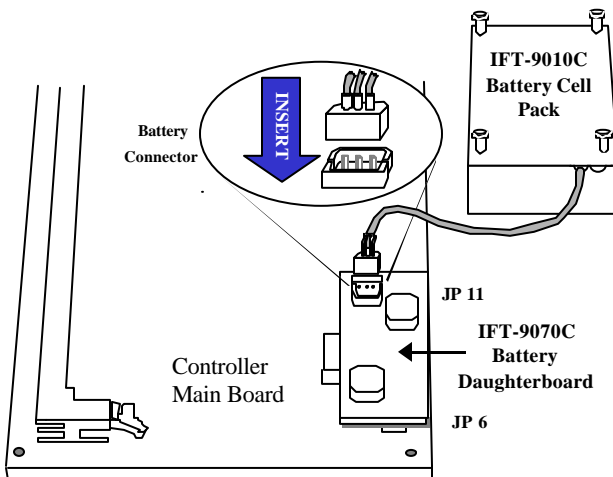
Connecting cell pack to the battery daughterboard

NOTE:

You must install the socket plug back to JP 11 once you have removed the IFT-9070C battery backup 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 JP 11.

Notice for the first installation:

1. It is possible that the linking cable connected between IFT-9070C daughterboard and IFT-9010C cell pack would have a surface contact with components on the controller main board. While routing the linking cable from one side to the other, please take it into your consideration that some chip surfaces should be avoided. The surface temperature on chips like SCSI/Fibre processors can be high enough to damage the plastic shielding of battery linking cable.

2. In order to make use of all the capacity of your battery cells, allow the battery cell pack to be fully charged when installed for the first time. The first time charge of battery cells takes about 24 hours to complete. When the installation of battery module is 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. Inspect regularly and replace every two years; use official battery pack replacement and use with specified RAID controllers only.

4. It is a must to disconnect battery back-up module before replacing DIMM module.

5. During normal use, an empty IFT-9010C takes about 20 hours to recharge.

6. It is a must to disconnect battery back-up module before replacing DIMM module.

7. 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%).

4.7 In-band SCSI

4.7.1 What is it and why do you need it?

When there comes a need to establish a communication between external devices and the host computer for device monitoring and administration, it is usually done through RS-232C ports.

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

How does it work with the SCSI cable?
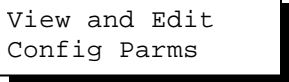
In-band SCSI technology translates the original commands into standard SCSI commands. These SCSI commands are then sent to and received from the SCSI RAID controller. It can be used to communicate between host and controller. The RAIDWatch manager, using the In-band SCSI to connect to host, can administrate the RAID controller just as it could before via RS-232C. (Note: It is assumed that users of In-band SCSI possess the following: a third-party SCSI adapter and a channel on their Infortrend RAID controller that can be designated as a host channel). Both of these are required for In-band SCSI communication between the host and the RAID controller).

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

4.7.2.1   RAID Controller Adjustments
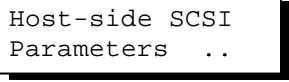
Use the front panel to configure the In-band SCSI settings.

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

```
View and Edit
Config Parms
```

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

```
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 have been completed.

4.7.3 Using TextRAID Manager

4.7.3.1   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 CD-ROM drive>:\3102\RaidUtils\ WIN95\ Raidman.exe.   The initial screen will prompt.
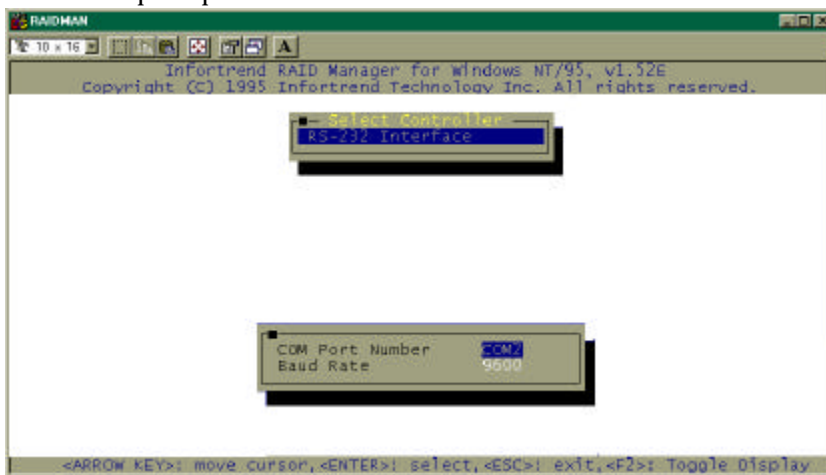
Change the COM port number to where you have connected the RS-232C serial and also set the baud rate identical to the baud rate setting of your controller.   You may also refer to the Generic Operation Manual for more details.

When finished with configuring the COM port and baud rate, press [**Esc**] to proceed.
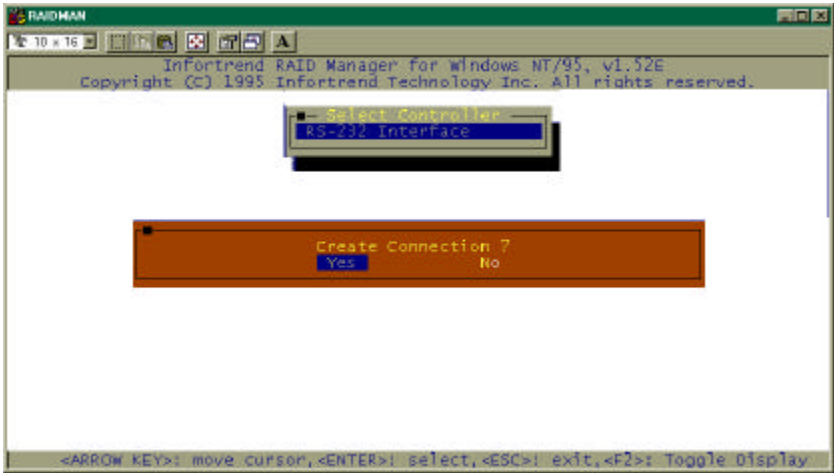
Choose Yes to establish the connection between host and controller.

Select "Controller Maintenance" or "Terminal Emulation" and press **[ENTER]** to proceed.
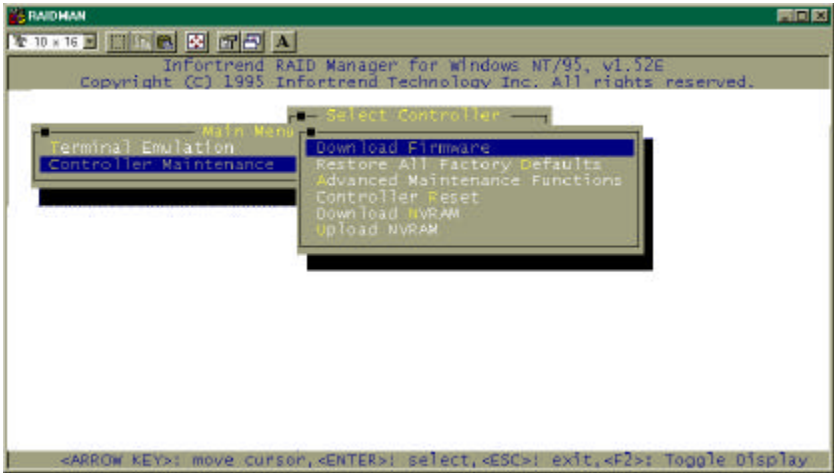
Now you can configure your RAID by the Raidman manager. The terminal emulation operations will be discussed in the *Generic Operation manual.*

4.8 Ventilation

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

4.9 Getting Ready to Use

4.9.1 Connecting Drive Channels and Host Channel(s)
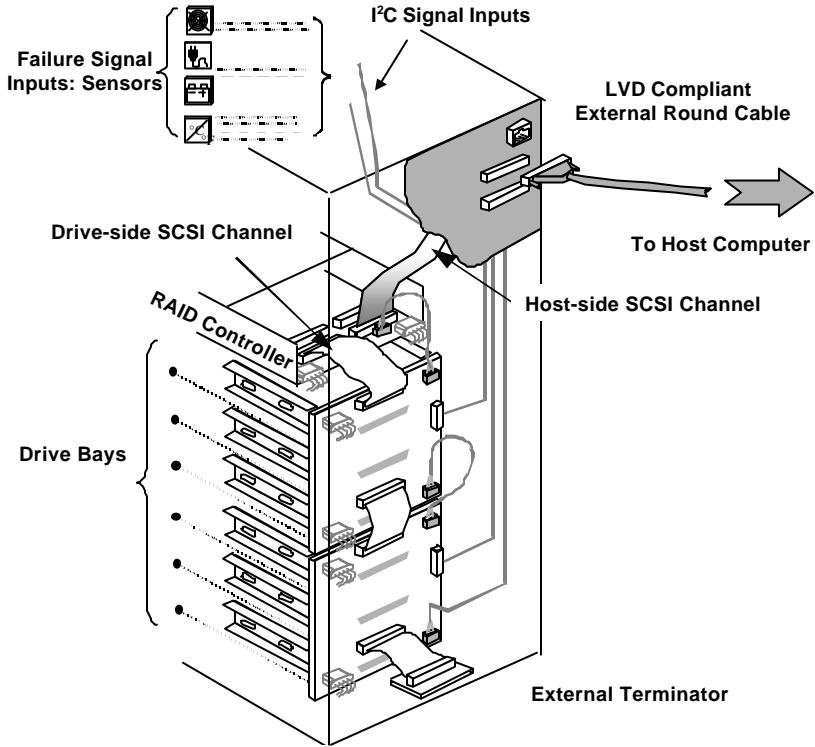
Above is an example of connecting RAID controller to drives in an enclosure and to the host computer. The on-board terminator has been enabled on the drive side SCSI channel. On the other end of the SCSI cable, an external terminator is applied. This ensures SCSI bus integrity even if one of the drives fails. Termination on all the SCSI drives should then be disabled. Note that the enclosure management may be built on different interfaces. Connection to the remote devices (fans rotation speed detector, power supply status, temperature sensors, etc.) may be using SAF-TE or the I^{2}C interface as displayed in the example.

Exemplary Cabling Topology:

An example of the operational setup is shown below:
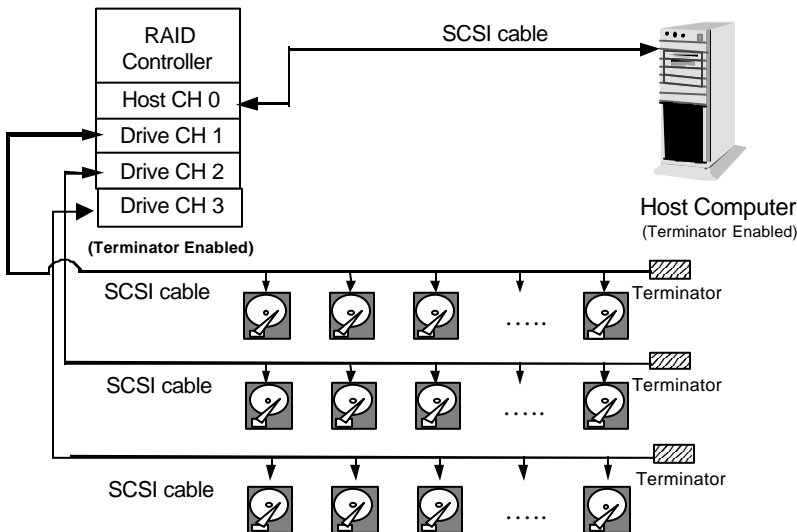
- The SCSI cable must be shorter than 12 meters using high-quality SCSI cable and terminators.

- Channel 0 is usually connected to the Host system.

- Drives are connected to drive channels 1 and/or 2.

- SCSI devices on the same channel have their own unique ID number.
- Both the host and drive SCSI cables are properly terminated.
- The terminator of all the hard drives must be disabled.
- The power supply is attached.
- All operation parameters are properly set.

To connect the components:

1. Make sure power is off or the power connector is disconnected.
2. Connect channel 0 of the controller to the Host system's SCSI port using a LVDs compatible external SCSI cable as recommended by the HBA vendor. Usually it is necessary to connect from the controller to the outside of RAID enclosure. Use cables recommended by HBA vendor.

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

3. Make sure the host side of the SCSI cable is properly terminated.
4. Assign a unique SCSI ID for every hard disks that are to be connected on the same SCSI cable; between ID numbers '0' and '6' and '8' and '15.' The default ID of the controller's channel 0 is '7'.
5. Connect the other end of the drive-side SCSI cable to one of the remaining channels on the controller.
6. Connect the connectors located at the middle of the drive SCSI cable to the hard disks.
7. Terminate the SCSI cable by installing an external terminator on the last connector. Terminators on all the hard drives must be removed or disabled so that removing a hard drive will not affect cable termination.

4.9.2 Connecting Host Channels to Host Computers

1. Locate the host channel SCSI connector on your RAID subsystem. A RAID subsystem is an enclosure that not only contains multiple disk drives but also is an assembly of power supply, cables, cooling fans, and environmental monitoring modules. Please refer to the manual of your RAID enclosure for detailed information.

RAID subsystem host channel SCSI connector
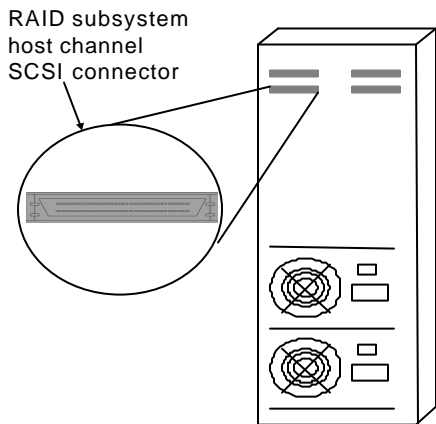
2. Locate the SCSI connector on your host computer.

Host system
SCSI connector
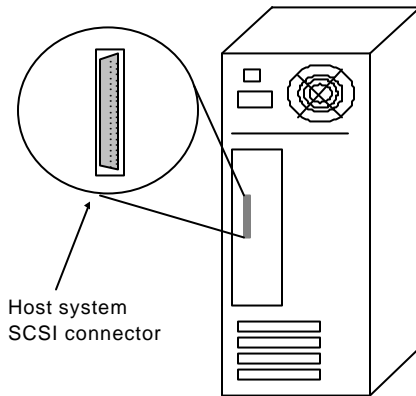
Note on Connecting to Host Bus Adapter:

- The synchronous clock or speed setting of HBA should be configured at its top-speed and "Wide" enabled.

- Any single-ended device on an Ultra2 SCSI bus should be removed. A single-ended device on an Ultra2 LVD bus will force the entire bus to adopt single-ended mode. The maximum transfer rate will be limited as Ultra-Wide, instead of Ultra2.

- An external round cable should be a LVD type cable recommended by HBA vendor.

3. Connect one end of the external SCSI cable to the connector on the subsystem and the other end of the cable to the connector on the host computer. The cable length and termination should follow the SCSI specification. For information about SCSI cable lengths and requirement for cabling, please refer to Appendix C.

Host system SCSI connector

RAID subsystem host channel SCSI connector
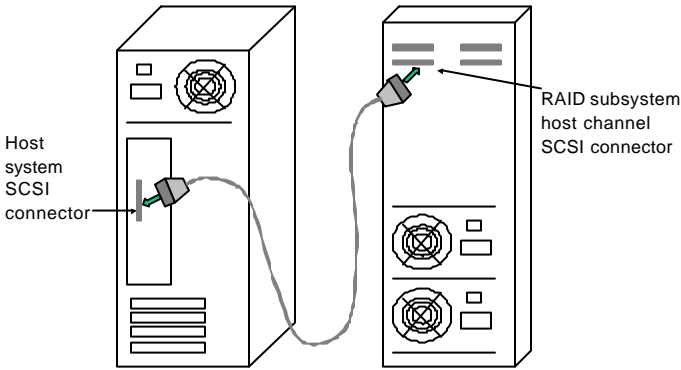
4.9.3 Connecting Power to RAID Subsystem

Please refer to your RAID enclosure manual for the location of the power connector and the safety instructions. If the RAID enclosure has dual power supplies, refer to the manual for detailed information on connecting the power cables.

RAID subsystem
power connector
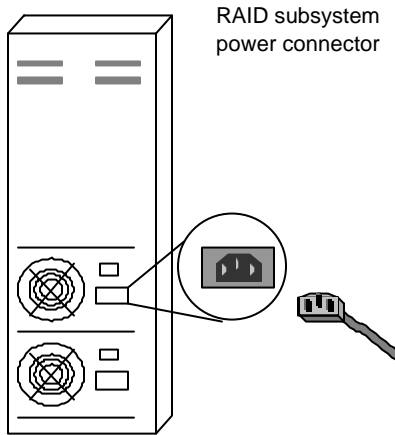
4.9.4 Power on the storage system

1. Power on the RAID system. If the SCSI buses are properly terminated, you should be able to hear the disk drives inside when they are spinning-up. Follow the boot device procedure as provided by the enclosure manufacturer. The RAID system should be powered on first before the host computer, since the RAID system usually takes a while to boot (waiting for the drives to be ready, then for the controller to be ready).

2. Normally all the storage will be used and should be ready before the host computer boots.

3. Wait for the controller LCD to indicate "READY" or "No Host LUN" before the host boots up.

4. Refer to the following diagram on how to read the LCD screen. The front panel LCD should light on. A few messages will appear on the LCD for a short while.

Product Model   **Firmware Version**

```
IFT-3202  v3.11F
Ready
```

Status/Data Transfer Indicator
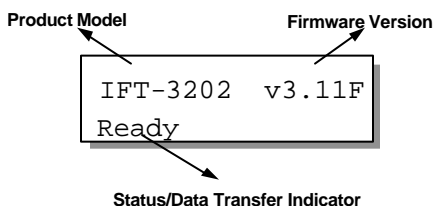
```
Initializing...
  Please Wait...
```
This screen is accompanied by two "beeps".

```
IFT-3202  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 -

```
IFT-3202  v3.11F
Ready
```
This is a normal message when a logical drive has been created and mapped to a host channel ID/LUN.

Chapter 5   System Information and Hardware Configuration

The working condition of a controller may easily be affected by different factors: over heating, unstable voltage, and hardware failure. In addition to the overall environmental conditions within the enclosure, the controller is equipped with the ability to self-monitor different aspects of its working condition and to automatically issue event message once an error occurs. Whenever the controller detects unstable or out-of-the-normal-range events, 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 RAIDWatch manager is installed, a notification message can be sent remotely via E-mail, pager, fax, and broadcast over LAN.

In this chapter, the discussion on system environmental monitoring will focus on the access to this controller-embedded function through LCD display and terminal emulation. For more information on 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 support of enclosure manufacturer's implementation. Please refer to the enclosure manual for details.

5.1   How to View System Environmental Information

5.1.1 Via LCD Push-button Panel

View Peripheral Device Status:
If the controller is properly installed, your LCD should be displaying the message as follows:

```
IFT-3202 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.

5.1.2 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.
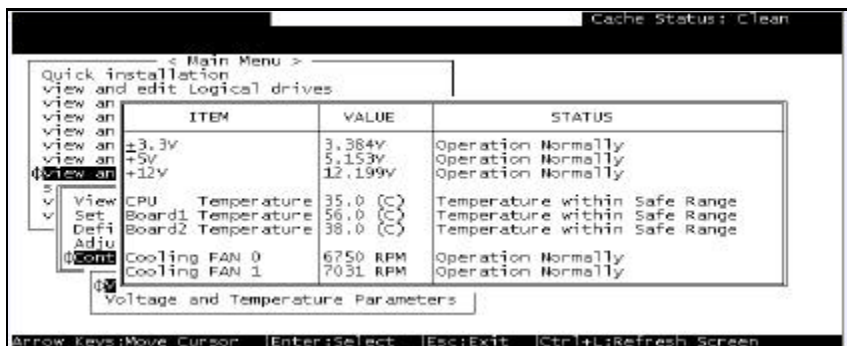
The current controller operation status will be displayed and defined as normal or out of the normal range.

5.2 How to Configure Threshold Parameters for System Environmental Monitoring
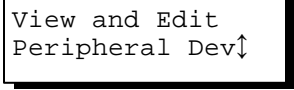
5.2.1 Via LCD Push-button Panel

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.

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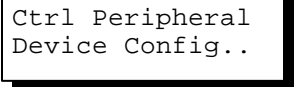
Temperature and Voltage Parameters:

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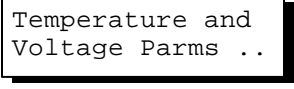
```
View and Edit
Peripheral Dev↕
```

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

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

Press ▼ or ▲ to select "Temperature and Voltage Parms..," 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.

5.2.2 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
 φview and edit Peripheral devices
  ┌─┬───────────────────────────────────────────────┐
  v │ View  │
  v │ Set   │ Trigger Thresholds for +3.3V Events
  Defi│ Trigger Thresholds for +5V Events
  Adju│ Trigger Thresholds for +12V Events
 φCont│ Trigger Thresholds for CPU Temperature Events
      │ Trigger Thresholds for Board Temperature Events
    ┌─┴─┐
    │ V │
    φVoltage 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.
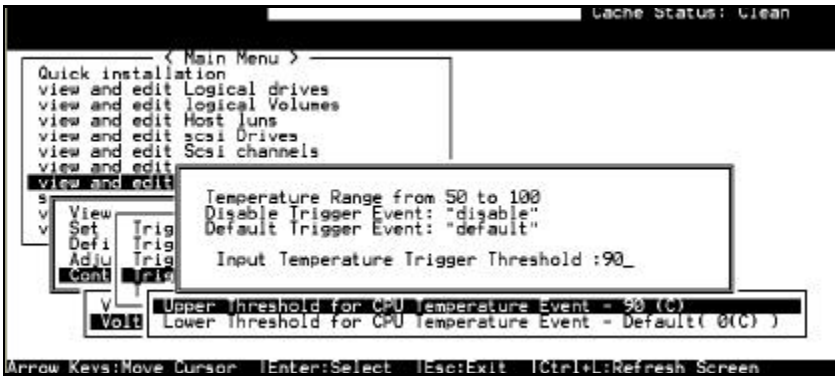
A configuration window will prompt. Enter any value within the safety range. Any out-of-the-range value will be rejected by controller firmware.
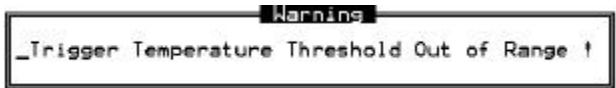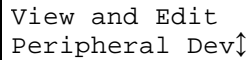
Follow the same method to modify other threshold parameters.

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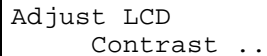
The controller LCD contrast has been configured in an acceptable range before shipping. To modify LCD contrast:

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.
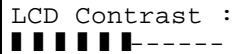
```
View and Edit
Peripheral Dev↕
```

```
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 the **[ESC]** key to confirm and leave.

5.4 System Functions

Mute Beeper

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

Via LCD front panel:

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

```
System Functions
               ↕
```

```
Mute Beeper
            ..
```

Press **[ENT]** to confirm.

```
Mute Beeper
            ?
```

Via terminal emulation:

```
                                             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
   system Functions
   v ┌────────────────────┐
   v │ Mute beeper        │
     ├─C──────────────────┘
     │R   Mute Beeper ?
     │S
     │C   Yes     No

Arrow Keys:Move Cursor  IEnter:Select  IEsc:Exit  ICtrl+L:Refresh Screen
```

Select "System Functions" from the main menu, press Enter to confirm. Select "Mute Beeper," and then press Enter. Choose yes to confirm.

Change Password

```
                                           Cache Status: Clean

           ─── < Main Menu > ───
  Quick installation
  view and edit Logical drives
  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
  system Functions
  v ┌──────────────────┐
    │ Mute beeper      │
    │ change Password  ├───────┐
    │ R                │       │
    │ C                │       │
    │    Old Password: │       │
    │                  │       │
    └──────────────────────────┘

Enter:Confirm   !Esc:Exit   !Ctrl+L:Refresh Screen
```
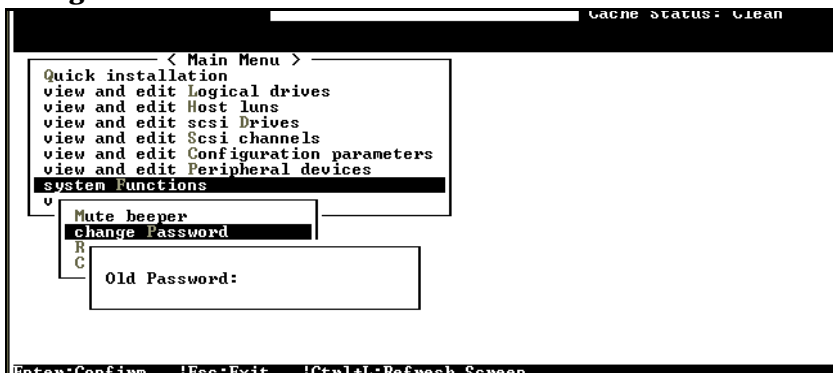
Use the controller's password to protect the controller from unauthorized entry. Once the controller's password has been set, regardless of whether the front panel, the RS-232C terminal interface or the GUI RAID Manager is used, the user can only configure and monitor the RAID controller by providing the correct password.

☞ **IMPORTANT:**

• *The controller will verify the password only when entering the Main Menu from the Initial screen or making configuration change. Always go back to the Initial screen when the controller is going to be left unattended.*

• *The controller password and controller name are sharing a 16-character space. The maximum characters for the controller password is 15. When the controller name occupied 15 characters, there is only one character left for the controller password and vice versa.*

Changing the Password

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

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

Key-in the old password, then press **[ENTER]**. If the password is incorrect, it will not allow you to change the password. Instead, it will

display the message "Password incorrect!," then go back to the previous menu.

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

Setting a New Password

```
                                             Cache Status: Clean

            ─── < Main Menu > ───
    Quick installation
    view and edit Logical drives
    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
  system Functions
  v ┌─────────────────┐
    │ Mute beeper     │
    │ change Password ├───────────────┐
    │ R │             │
    │ C ┌─────────────────────────┐
    │   │ New Password:           │
    │   │                         │
    └───┴─────────────────────────┘

 Enter:Confirm   :Esc:Exit   :Ctrl+L:Refresh Screen
```
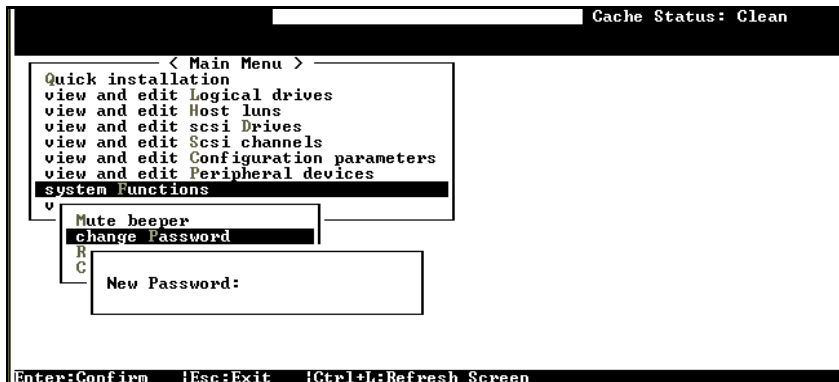
Enter the desired password in the column, then press **[ENTER]**. The next dialog box will display "Re-Enter Password." Enter the password again to confirm and press **[ENTER]**.

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

```
┌─────────────────┐
│ Disable         │
│ 1 minute        │
│ 2 minutes       │
│ 5 minutes       │
│ Always Check    │
└─────────────────┘
```
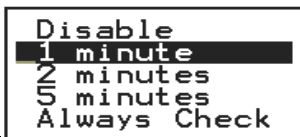
screen is going to be left unattended for a period of time, settings from 1 minute to 5 minutes are also available.

Reset Controller

```
                                              Cache Status: Clean

              ─── < Main Menu > ───
     Quick installation
     view and edit Logical drives
     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
     system Functions
     v ┌──────────────────────────┐
       │ Mute beeper              │
       │ change Password          │
       │ Reset controller         │
       │ C┌──────────────────────┐│
        └┤ Reset Controller ?   │
         │                      │
         │   Yes      No        │
         └──────────────────────┘

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

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

Shutdown Controller

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

```
                                              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
     syst
     v ┌─────────────────────────┐
     v │M │ Shutdown Controller ?  │
       │c │                       │
       │R │   Yes      No         │
       └──────────────────────────┘
       │ Shutdown controller     │
       │ Controller maintenance  │

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

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, and spanning multiple logical drives in a logical volume
Host O/S compatibility	Host O/S independent
SCSI channels	4 on base module
Host interface	Ultra2 SCSI Wide (base module)
Host channels	4, SentinelRAID 100; all channels can be host or drive channels
Drive interface	Ultra2 SCSI (base module)
Drive channels	Up to 3
Maximum number of SCSI drives	Up to 45 (with 3 drive channels)
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/volume, total of 64
Number of LUN's	Up to 32 per SCSI ID
Multiple SCSI ID's per host channel	Yes
Firmware on Flash memory	Yes
Drive hot swapping	Yes

A.2 Controller Architecture

Specification	Feature
CPU	PowerPC® 603e microprocessor
SCSI controllers	LSI 53C896 SCSI 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
Channel termination	LVD active termination, configurable via DIP switch
I/O channel bandwidth	Ultra2 Wide SCSI: up to 80 Mbytes/sec

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 (x86 and SPARC), Linux]
Performance monitoring	Yes
Remote control and monitoring	Yes
Event broadcast/alert	Yes (via RAIDWatch Manager or the direct connection to a modem)
Hardware connection	In-band SCSI , In-band Fibre or RS-232C
Failure indicator	Via buzzer, front panel, RAIDWatch Manager or terminal emulation

A.4   Fault Tolerance

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

Salvage the 1st temporary failed drive in a RAID 0 logical drive	Yes

A.5   Software

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

A.6 Controller Specifications

Specification	Feature
Controller size (in frame)	224mm x 146mm x 40.8mm (L x W x H)
main board size (without backplane)	211 x 140mm
Main board height with daughterboard	1.19"
CPU	PowerPC® 603e microprocessor
Cache memory	32MB to 1GB, SDRAM DIMM socket x1 with ECC support
Firmware	2MB Flash memory
NVRAM	32KB
Operating voltage	+5VDC ± 5% (max. 5.0A; normal 4.0A) +12VDC ± 10% (max. 1000mA)
Operating temperature	4 to 44°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	SCSI: up to 15 wide SCSI 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
SCSI connectors	68-pin high-density connectors (x 4)
SCSI cables	Up to 12 meters with low-voltage differential
Serial port	10-pin box headers for COM1 & COM2
LCD panel	Yes
LED and push-button interface	Yes

Appendix B   Hardware Troubleshooting

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

PROBLEM	CHECK
LCD is off	Check power connections of the board and LCD panel. Requires minimum of 32 MB SDRAM DIMM installed.
SCSI channel failure detected upon start-up (SCSI cables connected) Message on LCD: `SCSI CHLs fail` `CHL=x,x,x`	Check ID numbers (must be unique for each device on the same SCSI channel). Make sure that all SCSI channels are properly terminated. Check the voltage output of the power supply.
Initialization failure	Check ID numbers (must be unique for each device on the same SCSI channel). Make sure terminators are properly installed.
Cannot detect SCSI drive	Check drive power connections. Check drive SCSI cable connections. Check ID numbers (must be unique for each device on the same SCSI channel).
Host can not detect SentinelRAID 1000/2000	Check host SCSI cable connections. Check SCSI port to LUN assignment. Check logical drive mapping to LUN.
Parity error detected	SDRAM DIMM should be replaced.
Logical drive failure detected during boot-up	Check proper installation or connection of the drives (use the "View SCSI drives" function to help locate the problem).

System is not stable after running for a period of time.	SCSI cable length must be within the range of specifications. Make sure terminators are proper installed. Power supply voltage must be within specification. Check the enclosure's inner temperature.
The RS-232C Terminal Interface does not work.	Check RS-232C cable connections. Check if the Baud Rate setting on both ends identical. Enable Terminal Emulation. 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 configurations are completed.
The logical drive states "INVALID".	"Optimization for ... I/O", when creating the logical drive in Cache Parameter, is different from the current setting. Change "Optimization for ...I/O" to the opposite setting and reset the controller.
In "View and Edit SCSI Drives" or "View and Edit SCSI Channels", the speed is only "40Mhz", not "80Mhz"	"40Mhz" is SCSI sync frequency, not transfer rate.
All settings are too complex to remember.	After the system installation is complete, write down all the settings and related information in Chapter 8 of your "Generic Operation Manual" for future reference.

Upon replacing the failed controller with a new one during Redundant controller connection, nothing appears on the LCD of the new controller.	Set the new controller as "redundant controller enabled" before connecting to the active controller. Connect the new controller to the active controller and choose "Deassert failed controller" on the active controller. Refer to "Chapter 11 Redundant Controller" in your Generic Operation Manual for more details.
`Error: Check` `DRAM Installed?`	Check to see if a DIMM module is installed or properly installed.
`IFT-3202  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.
`IFT-3202  v3.11F` `Ready`	This is a normal message when a logical drive has been created and mapped to a host channel ID/LUN.
`[Other error` ` messages]`	Please contact your dealer for assistance with any other error messages.

Appendix C   SCSI 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.)

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	1-bit	1 GHz	100 MB/Sec

Appendix D   General Identification and Pin Assignments
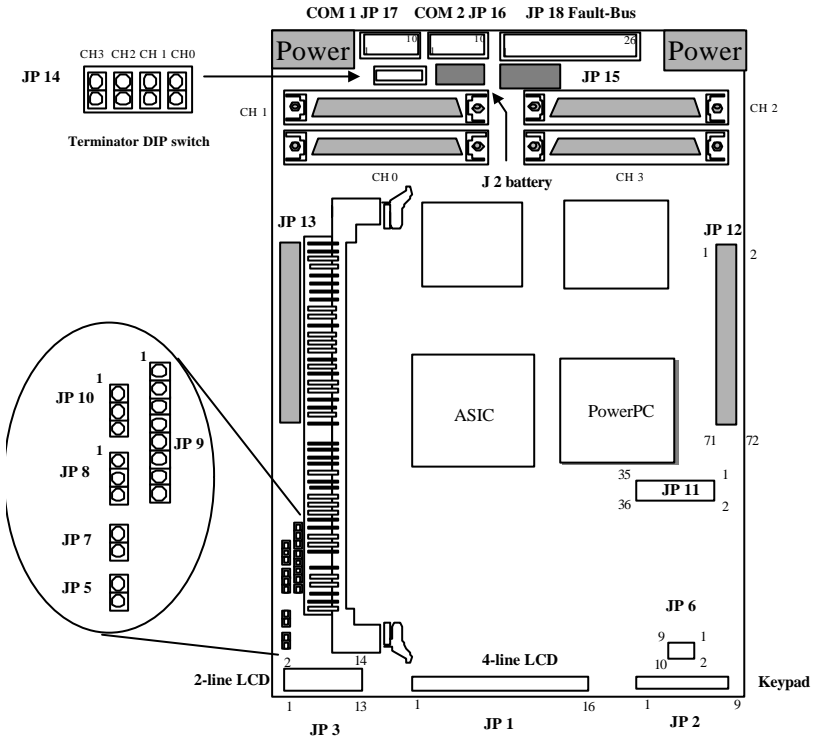
Connector	Description
J 2	**Battery cell pack connector**
JP 1	**4-line LCD**
JP 2	**Keypad**
JP 3	**2-line LCD**
JP 3	**Redundant controller connection**
JP 5	**NMI – non mask interrupt (Enabled: shorted)**
JP 6	**Battery daughterboard connector 2x5 pin header**
JP 7	**Reset (Enabled: 1-2 shorted)**
JP 8	**Loop-back test (Enabled: 2-3 shorted; normal: 1-2 shorted)**
JP 9	**GAL**
JP 10	**LCD type selection (4-line: 1-2 shorted; 2-line: 2-3 shorted)**
JP 11	**Battery daughterboard connector 36-pin header**

JP 12	Daughterboard upgrade socket-not functional at this stage of development
JP 13	Daughterboard upgrade socket –not functional at this stage of development
JP 14	Terminator DIP switch jumpers channel 0 to channel 3 : (Force Enabled: short)
JP 15	I^{2}C port
JP 16	COM 2
JP 17	COM 1
JP 18	Fault-Bus

JP 16 RS-232C Port

Pin	Descriptions	Pin	Descriptions
1	DCD1	6	DSR1
2	RXD1	7	RST1
3	TXD1	8	CTS1
4	DTR1	9	RT1
5	GND	10	N/C

JP 17 RS-232C Port

Pin	Descriptions	Pin	Descriptions
1	DCD2	6	DSR2
2	RXD2	7	RTS2
3	TXD2	8	CTS2
4	DTR2	9	RS232 RESET
5	GND	10	N/C

I²C Port

I²C Port Pinouts

Pin	Pin name
1	I²CCLK
2	GND
3	VCC
4	I²CDATA

I²C Connector Pin Name Descriptions:

Pinout Description

Symbol	Type	Description
GND	G	Signal ground
I2CCLK	O	I²C clock
I2CDATA	O	I²C 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

JP 18 Fault-Bus Plus Port

Pin	Descriptions	Pin	Descriptions
1	Slot 1	2	Slot 5
3	Slot 2	4	Slot 6
5	Slot 3	6	Slot 7
7	Slot 4	8	FBUS_RST
9	GND	10	GND
11	Slot 8	12	Slot 12
13	Slot 9	14	Slot 13
15	Slot 10	16	Slot 14
17	Slot 11	18	N/C
19	GND	20	GND
21	UPSOUT#	22	N/C
23	POWER#	24	TEMP#
25	UPSIN#	26	FAN#

Standard RS-232C cable, customer provided

IFT-9016

IFT-9011

RS-232

Controller
COM Port

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

Standard PC
Serial COM Port
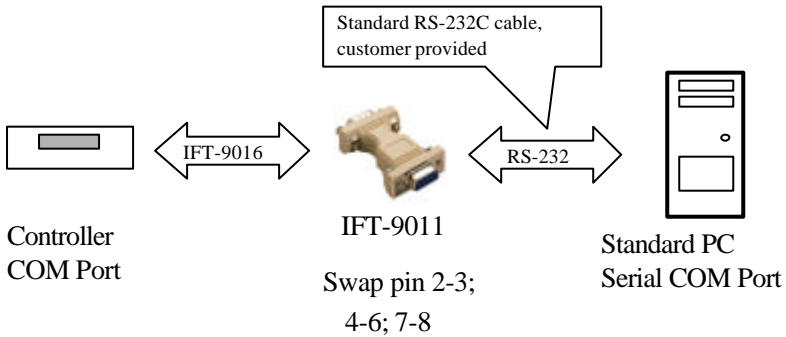
IFT- 9011 Null Modem

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

IFT-9012 RS-232C Extension Cable (not included in kit)

Extend the cable length only, no wire swap.