

ftServer 5200 Technical Service Guide

Draft (Last Updated 12/07/01)



Revision History Since FCS

7/31/01 - Updated Section 7.

8/31/01 - Added Fibre Channel Storage Subsystem information to Sections 1, 3A, 3B, 4, 6, 7, and Appendix B. Information is in RED font for review purposes.

9/12/01 - Updated Section 7.6.

9/27/02 - Updated Sections 1.3.3.1 and 7.3.

12/07/01 - Updated Section 7.2.

Notice

The information contained in this document is subject to change without notice.

STRATUS TECHNOLOGIES, INC. MAKES NO WARRANTY OF ANY KIND WITH REGARD TO THIS MATERIAL, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Stratus Technologies, Inc., shall not be liable for errors contained herein or incidental or consequential damages in connection with the furnishing, performance, or use of this material.

Software described in Stratus documents (a) is the property of Stratus Technologies, Inc., or the third party, (b) is furnished only under license, and (c) may be copied or used only as expressly permitted under the terms of the license.

This document is protected by copyright. All rights are reserved. No part of this document may be copied, reproduced, or translated, either mechanically or electronically, without the prior written consent of Stratus Technologies, Inc.

All trademarks are the property of their respective owners.

Manual Name: *ftServer 5200 Technical Service Guide*

Stratus Technologies, Incorporated

Customer Service Documentation Department

Warning

The equipment documented in this manual generates and uses radio frequency energy, which if not installed and used in strict accordance with the instructions in this manual, may cause harmful interference to radio communications. The equipment has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment.

Operation of this equipment in a residential area is likely to cause interference, in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

This document contains **Stratus Proprietary and Confidential Information**. It is provided to you and its use is limited by the terms of your contractual arrangement with Stratus regarding maintenance and diagnostic tools.

Copyright© 2001 by Stratus Technologies, Inc. All rights reserved.

Preface

The *ftServer 5200 Technical Service Guide* contains technical information pertinent to ftServer systems operating under Microsoft Windows 2000 Advanced Server operating systems.

This document is organized as follows:

Section 1 - Introduction

Section 2 - Operation and Maintenance Procedures

Section 3A - - FRU Removal and Replacement Procedures

Section 3B - DRU Removal and Replacement Procedures

Section 4 - Theory of Operation

Section 5 - Upgrades

Section 6 - Related Documentation

Section 7 - Part Numbers

Audience

This guide is intended for authorized service personnel who install and maintain Stratus systems, and who have completed Stratus field-service training courses.

1. Introduction

This section describes the requirements, components, configurations, and upgrade options for Stratus Server systems. It covers the following topics:

- [Overview](#)
- [Operating system requirements](#)
- [Hardware components](#)
- [System configurations](#)
- [System specifications](#)

1.1 Overview

The ftServer 5200 is a mid-range fault tolerant system based on the Intel IA-32 architecture (32-bit, 750-MHz processor, 256 KB L2 cache). It incorporates Intel Pentium III Xeon technology into a rack-mounted platform. Fault tolerance is achieved through double and triple modular redundancy (DMR and TMR). DMR is two CPU modules running in lockstep. TMR is three CPU modules running in lockstep.

The ftServer 5200 system currently is a standalone cabinet. No expansion cabinets are supported. The cabinet is a 42" or 66" high (approximate), 19" rack enclosure that houses the front panel, two or three independent CPU subsystems in support of both DMR and TMR configurations, one I/O subsystem with redundancy (two I/O enclosures), one mirrored disk subsystem (in one or two storage enclosures, each containing up to eight disk drives), a fault tolerant power subsystem, and a system control and monitoring (M&D) subsystem.

Tape drives are supported externally to the cabinet.

1.2 Operating System Requirements

ftServer 5200 is currently supported by the following operating system:

- Microsoft Windows 2000 Advanced Server

The following software availability features are included:

- Online dump/enhanced crash analysis
- Persistent memory (PM)
- System and application monitoring
- Hardened drivers
- Software (SW) revision level reporter
- Online driver upgrades

Online dump/enhanced crash analysis saves the crash dump from one of the DMR/TMR boards after rebooting the system on one or two of the other boards. This feature makes it possible to obtain a complete dump for the system at the time it crashed without enduring a lengthy outage time during which the dump is created and then copied.

Persistent memory is a region of physical memory (RAMDISK) that survives a system reboot. It combines the speed of memory and the reliability of a disk. PM gives applications, which have large in-memory databases, a way to quickly restart after a reboot without reconstructing their in-memory databases.

System and application monitoring tools provide proactive analysis of system operation. The monitoring is designed so that warnings and/or actions can be taken to forestall any outage caused by software options.

Hardened drivers support dual paths and failover, provide virtual memory address protection, and eliminate crash points.

Software revision level reporter is a tool that determines the revision level of the operating system, Stratus-provided software, service packs, system files, and DLLs. The reporter automatically reports this data to the Customer Service Site Management Database.

Online driver upgrades provide the ability to upgrade a device driver without rebooting the system and with minimal disruption to the functions provided by the device driver.

1.3 Hardware Components

1.3.1 CPU Enclosure

The CPU enclosure is a 19" rack-mounted unit that supports one or two processors operating at up to 750 MHz. The system bus operates at 100 MHz. Up to four 256-MB or 512-MB SDRAM DIMMs (memory modules) are supported in configurations of 256 MB, 512 MB, 1 GB, and 2 GB. The first slot (slot 0) must always be populated.

The CPU enclosure has an integrated 450-Watt AC power supply. Power fault detection is provided.

Fault indicators, located on the rear and front of the CPU enclosure, utilize a set of two LEDs: one red and one bicolor (yellow/green).

For a detailed description of the CPU enclosure, refer to [Section 4.1](#).

The following table lists model numbers and gives a brief description of the CPU and memory modules supported in ftServer 5200 systems.

Model	Description
AS000380	750 MHz CPU with 256 KB cache
M223	256-MB memory module
M222	512-MB memory module

1.3.2 PCI Console Shelf

The PCI console shelf consists of the following components:

- LVDS backplane
- LVDS I/O power and distribution PCB
- Core I/O enclosures (2)
- Optional expansion I/O enclosures (2)
- Power supply unit (2)
- Fault tolerant clock cards (2)
- Front panel

For a detailed description of the PCI console shelf, refer to [Section 4.2](#).

The following table lists the PCI adapters/cables supported on ftServer5200 systems.

Model	Description
U460	ftServer Access Adapter
U514	64bit/33MHz fibre channel Adapter
U515	1-port 10/100 Mbp ethernet Adapter
U516	1-port Ultra2 SCSI Adapter
U518	2-port Ultra2 SCSI adapter
U451	Digi Async Acceleport XR PCI Adapter with 8-port EIA-232 connectivity
U570	Gigabit Ethernet Adapter
U480	2-Port Synchronous PCI Adapter
U485	4-Port Synchronous PCI Adapter

1.3.3 Storage Subsystem s

1.3.3.1 SCSI Storage Subsystem

Each SCSI storage enclosure houses the following components:

- hot-pluggable 3.5" disk drives (2-8)
- power supplies (1 or 2)
- fan units (2 or 3)
- two I/O terminator modules (1 or 2)
- two Repeater-Enclosure Services Modules (RESMs) (1 or 2)

The minimum configuration of the storage enclosure is two disk drives, one power supply, two fan units, one

R-ESM, and one I/O terminator module. The maximum number of SCSI storage enclosures is two; therefore, the maximum number of disk drives in the system is 16 (eight duplexed).

The disk enclosure has three LED's: power on, split SCSI bus mode, and enclosure fault.

For a detailed description of the SCSI storage enclosure, refer to [Section 4.4](#).

The following table lists the disk drives supported on ftServe5200 systems.

Model	Description
D512-10	18-GB disk drive (10K RPM)
D512-20	18-GB disk drive (10K RPM)
D513-10	36-GB disk drive(10K RPM)
D513-20	36-GB disk drive(10K RPM)
D517-00	73-GB disk drive(10K RPM)
D518-00	18-GB disk drive (15K RPM)

1.3.3.1 Fibre Channel RAID Storage Subsystem

The optional Fibre Channel RAID disk subsystem consists of a pair of host bus adapters (PCI cards) and at least one Fibre Channel Storage enclosure (maximum of three). The Fibre Channel storage enclosure can be used in a 19-inch rack mount or in a floor mount configuration

The Fibre Channel RAID disk subsystem is a complete, fully redundant, rack mountable Fibre Channel storage solution. Each enclosure is 3U in height and can contain up to 14 Fibre Channel disk drives. The first (main) enclosure (D570) contains the following components:

- two RAID controllers (each with 128MB of ECC cache)
- two Advanced Cooling Modules (ACMs), each with battery backup unit (BBU)
- two Power Supply Modules (PSMs)
- two Loop Resiliency and SES Modules (LSMs)
- two to 14 disk drives

The second and third enclosures (D580) are daisy chained to the first. Each D580 contains the following components:

- two I/O modules
- two Advanced Cooling Modules (ACMs), with no battery
- two Power Supply Modules (PSMs)
- two Loop Resiliency and SES Modules (LSMs)
- two to 14 disk drives

The two ACMs in the D570 can contain optional BBUs for maintaining memory content in the RAID

Controllers' cache in case of an AC power failure.

One or two D580 Fibre Channel RAID expansion enclosures, each with a maximum capacity of 14 Fibre Channel drives, can also be added to the Fibre Channel RAID disk subsystem. This provides for a maximum capacity of 42 Fibre Channel drives.

A pair of U514 host bus adapters (HBA) is required for fault tolerant operation. The Qlogic 2300 with copper connectors is the fibre channel HBA, along with a Stratus hardened driver.

The following table lists the fibre channel disk drives supported on ftServer5200 systems.

Model	Description
D574	36-GB 10K RPM disk drive
D575	73-GB 10K RPM disk drive

1.3.4 Tape Drives

ftServer 5200 systems support DLT 8000 and DDS-4 tabletop tape drives. No tape drives are mounted in the storage enclosure. They are all external to the cabinet.

For a detailed description of the tape drives, refer to [Section 4.5](#).

The following table lists the tape drives supported on ftServer5200 systems.

Model	Description
T511	DDS-4 DAT tape drive
T512	DDS-4 DAT tape drive with autoloader
T513	DLT 8000 tape drive

1.3.5 CPU-to-PCI Console Bus

The CPU-to-PCI console bus connects the CPU enclosure to the PCI console shelf utilizing LVDS technology to transmit and receive data. The CPU-to-PCI console bus consists of uni-directional point-to-point links that are 32 bits wide operating at 66 MHz.

For a detailed description of the CPU-to-PCI console bus, refer to [Section 4.3](#).

1.3.6 Power Subsystem

The power system topology consists of multiple integrated AC-DC power supplies. These power supplies are co-located with the major system elements. Due to the overall system redundancy, there is no requirement for an N+1 topology for power within the CPU enclosure or PCI console shelf. The disk shelf has N+1 power

because it is a shared system resource.

The system requires two power cords connected to two independent AC sources and two exclusive branch circuits.

For a detailed description of the power subsystem, refer to [Section 4.6](#).

1.4 System Configurations

1.4.1 ft Server 5200 Configuration Matrix

Marketing ID	P3501-1D	P3501-2D	P3501-1T	P3501-2T
Processor	DMR	DMR	TMR	TMR
Symmetric Multiprocessor Protocol (SMP)	1-way	2-way	1-way	2-way
Processor speed	750 MHz,	750 MHz	750 MHz	750 MHz
Cache size	256 KB	256 KB	256 KB	256 KB
No. CPU Enclosures	2	2	3	3
No. physical CPUs	2	4	3	6
No. memory modules/CPU enclosure	Min. = 1 Max. = 4	Min. = 1 Max. = 4	Min. = 1 Max. = 4	Min. = 1 Max. = 4
Total duplexed memory	Min. = 256 MB Max. = 2 GB	Min. = 256 MB Max. = 2 GB	Min. = 256 MB Max. = 2 GB	Min. = 256 MB Max. = 2 GB
No. disk drives per system	Min. = 2 Max. = 24	Min. = 2 Max. = 24	Min. = 2 Max. = 24	Min. = 2 Max. = 24
Total duplexed disk storage per system	Min. = 9 GB Max. = 432 GB	Min. = 9 GB Max. = 432 GB	Min. = 9 GB Max. = 432 GB	Min. = 9 GB Max. = 432 GB
No. tape drives per system	Min. = 0 Max. = 4	Min. = 0 Max. = 4	Min. = 0 Max. = 4	Min. = 0 Max. = 4
No. I/O enclosures per system	Min. = 2 Max. = 4	Min. = Max. =	Min. = 2 Max. = 4	Min. = 2 Max. = 4
No. U516 1-port SCSI adapters per system	Min. = 0 Max. = 2	Min. = 0 Max. = 2	Min. = 0 Max. = 2	Min. = 0 Max. = 2
No. U518 2-port SCSI adapters per system	Min. = 2 Max. = 2	Min. = 2 Max. = 2	Min. = 2 Max. = 2	Min. = 2 Max. = 2
No. U515 1-port Ethernet adapters per system	Min. = 2 Max. = 12	Min. = 2 Max. = 12	Min. = 2 Max. = 12	Min. = 2 Max. = 12
No. U460 ftServer Access adapters per system	Min. = 2 Max. = 2	Min. = 2 Max. = 2	Min. = 2 Max. = 2	Min. = 2 Max. = 2

1.4.2 Cabinet Configurations.

The following table lists the unit (U) sizes of the ftServer cabinet components. Sections 1.4.2.1 and 1.4.2.2 show the possible configurations for 38U and 24U cabinets.

Cabinet Component	Size
CPU Enclosure	4U
PCI Console Assembly	8U
Disk storage enclosure	3U
Monitor	11U
Keyboard and Mouse	2U
Filler Panel	1U
CPU Filler Panel	4U

1.4.2.1 38U Cabinet Configurations (ftServer 5200.)

Upgradable DMR

Filler Panels
Storage Enclosure or Filler Panel
Storage Enclosure
PCI Console Shelf
CPU Enclosure
CPU Enclosure
CPU Filler Panel

DMR

Filler Panels
Storage Enclosure or Filler Panel
Storage Enclosure
PCI Console Shelf
CPU Enclosure
CPU Enclosure

DMR with Monitor

Filler Panels
Storage Enclosure or Filler Panel
Monitor
Keyboard
Storage Enclosure
PCI Console Shelf
CPU Enclosure
CPU Enclosure

Dual DMR

Storage Enclosure
PCI Console Shelf
CPU Enclosure
CPU Enclosure
Storage Enclosure
PCI Console Shelf
CPU Enclosure
CPU Enclosure

TMR

Filler Panels
Storage Enclosure or Filler Panel
Storage Enclosure
PCI Console Shelf
CPU Enclosure
CPU Enclosure
CPU Enclosure

TMR with Monitor

Filler Panels
Monitor
Keyboard
Storage Enclosure
PCI Console Shelf
CPU Enclosure
CPU Enclosure
CPU Enclosure

Upgradable DMR with Monitor

Filler Panels
Monitor
Keyboard
Storage Enclosure
PCI Console Shelf
CPU Enclosure
CPU Enclosure
CPU Filler Panel

NOTE: The Upgradable DMR, DMR, DMR with Monitor, and TMR configurations require one pair of power strips (each strip contains six plugs) if they have only one storage enclosure. If they have two storage enclosures, they require two pairs of power strips. The TMR with Monitor configuration requires one pair of power strips. The Dual DMR configuration requires two pairs of power strips.

1.4 2.2 24U Cabinet Configurations (ftServer 5200)

Upgradable DMR

DMR

TMR

Filler Panel
Storage Enclosure
PCI Console Shelf
CPU Enclosure
CPU Enclosure
CPU Filler Panel

Filler Panels
Storage Enclosure or Filler Panel
Storage Enclosure
PCI Console Shelf
CPU Enclosure
CPU Enclosure

Filler Panel
Storage Enclosure
PCI Console Shelf
CPU Enclosure
CPU Enclosure
CPU Enclosure

NOTE: All 24U cabinet configurations require one pair of power strips.

1.5 System Specifications

1.5.1 Physical

	38 U Cabinet	24 U Cabinet
Height	1.9 m (74 in)	1.3 m (50 in)
Width	69 cm (27 in)	69 cm (27 in)
Depth	86 cm (34 in)	86 cm (34 in)
Weight	409 kg (900 lbs) max. configuration	225 kg (495 lbs)
Service Clearance	76 cm (2.5 ft) minimum space front and rear	76 cm (2.5 ft) minimum space front and rear

1.5.2 Environmental

Operating Temperature	
-200 to 6,000 ft.	+5° C to +35° C (41° F to 95° F)
6,000 to 8,000 ft.	+5° C to +30° C (41° F to 86° F)
8,000 to 10,000 ft.	+5° C to +25° C (41° F to 77° F)
Maximum Rate of Temperature Change	12° C (21.6° F) per hour or 0.2° C (0.36° F) per minute

Storage Temperature (To 40,000ft.)	-40° C to +70° C (unvented) -40° C to +60° C (vented)
Relative Humidity:	
Operating	10% to 80% Non-condensing
Storage	10% to 95% (max. absolute humidity of 0.024 water/lb. of dry air)
Heat Dissipation	Dependent on the system configuration. See Section 1.5.2.1.
Acoustical Noise:	72 dbA (max)

1.5.2.1 Heat Dissipation Requirements

System Configuration	BTU/hr
38U Cabinet	
DMR	5314
DMR with monitor, keyboard, and mouse	5622
DMR with additional storage enclosures	7363
Dual DMRs	8327
DMR (upgradeable toTMR)	5953
TMR	5953
TMR with monitor, keyboard, and mouse	6260
24U Cabinet	
DMR	5314
DMR (upgradeable toTMR)	5953
TMR	5953

1.5.3 Electrical

AC input voltage	120-240VAC RMS, maximum 10% harmonic distortion
AC input frequency	47-63 Hz
Power	Dependent on the system configuration. See Section 1.5.3.1.

1.5.3.1 Power Requirements

System Configuration	Watts
38U Cabinet	
DMR	1556

DMR with monitor, keyboard, and mouse	1646
DMR with additional storage enclosures	2156
Dual DMRs	2438
DMR (upgradeable toTMR)	1743
TMR	1743
TMR with monitor, keyboard, and mouse	1833
24U Cabinet	
DMR	1556
DMR (upgradeable toTMR)	1743
TMR	1743

2. Operation and Maintenance Procedures

This section describes software procedures related to service maintenance. It covers various topics, including the following:

- System Startup
- System Shutdown
- Device IDs
- System Handling of Hardware Events
- Troubleshooting Failed Components
- Front Panel LCD Messages

2.1 System Startup

Whenever the system is plugged into live AC outlets and the power strips are turned on, the PCI console assembly is powered up. This "standby" power keeps the I/O system operational even when the rest of the system is powered off. If the Windows 2000 operating system is not running, starting, or stopping, you can initiate a start-up sequence that will power-up the rest of the system and start Windows 2000.

To initiate this power-up sequence, perform the following steps:

1. Make sure the system power cords are plugged into live AC outlets and the circuit breaker on top of each power strip is ON.
2. Make sure the ON/OFF switches on the SCSI storage enclosures are ON.
3. Turn on the monitor and any other peripheral devices.
4. On the front panel, press the system power button and hold it down for a four seconds. This powers on the rest of the system and causes the Windows 2000 operating system to boot.

NOTE: The front panel system power button is recessed on the right side of the front panel port access area. If the system is in a **Power Off** state, pressing the power button for five seconds **powers on** the system and starts the FRB sequence. If the system is in a **Power On** state and the OS is shutdown, pressing the power button for five seconds **powers off** the system.

2.2 System Shutdown

If the ftServer system has a monitor, keyboard, and mouse, use Windows 2000 to shut down the system.

If the ftServer system does not have a monitor, you can access the system remotely through the ftSAC Remote Console or through the Virtual Network Computing (VNC) service, and perform the preceding procedure.

Before shutting down the ftServer, warn all users that a shutdown is imminent so that they have time to save their files and exit their applications. Give users sufficient time to exit.

Perform the following procedure to gracefully shut down an ftServer system running Windows 2000. Any Windows settings will be saved and the contents of memory are saved to disk. The operating system should always be shut down in this manner if at all possible.

1. Click the **Start** button on the Windows 2000 desktop and click **Shut Down**.

2. In the Shut Down Windows dialog box, select **Shut Down** in the dropdown list and then click **OK**. A message states that your system is shutting down. After the system shuts down, a message appears stating that it is safe to power off the system.
3. Turn off power to any peripheral devices.
4. Press the front panel system power button for four seconds to shut down system power. (ftServer standby power remains on.)

NOTE: The front panel system power button is recessed on the right side of the front panel port access area. If the system is in a **Power Off** state, pressing the power button for five seconds **powers on** the system and starts the FRB sequence. If the system is in a **Power On** state and the OS is shutdown, pressing the power button for five seconds **powers off** the system.

2.3 Device IDs

A device ID is an identifier used to physically locate hardware components within a Stratus system. This section describes the scheme used to identify all devices in ftServer systems running the Windows 2000 operating system. The basis of the scheme is a unique device ID that is assigned to each physical device in the system.

A component's device ID specifies the address of all the hardware components leading to a device. It is a hierarchical number where each level is used to represent a different layer of the physical hardware in the system. Each level in the device ID represents a CRU or FRU. The following subsections describe the device IDs.

2.3.1 Level 1 Devices

Level 1 devices fit directly into the system chassis. They are shown in the following table.

NOTE: Notice that there isn't much consistency in the numbering scheme. Also, some devices are numbered right to left, some are numbered left to right, and others are numbered top to bottom.

Level 1 Device	Possible Device IDs	Numbering Scheme	Viewed from (Front or Rear)
CPU Enclosures	0 1 2	Top to bottom	Either
Core I/O enclosure	10 11	Right to left	Rear
Expansion I/O enclosure	12 13	Right to left	Rear
Clock Cards	20 21	Left to right	Front
Front Panel	30	NA	Front
Storage Enclosures	40 41 42		Rear

2.3.2 Level 2 Devices

Level 2 devices consist of components that plug into Level 1 devices. They are shown in the following table.

Level 2 Device	Possible Device IDs	Numbering Scheme	Viewed from (Front or Rear)
Core I/O enclosure Slots	10/0, 10/1, 10/2, 10/3 11/0, 11/1, 11/2, 11/3	Left to right	Rear
Expansion I/O enclosure Slots	12/0, 12/1, 12/2, 12/3 13/0, 13/1, 13/2, 13/3	Left to right	Rear
CPU-to PCI Console Cables	0/0 1/1 2/2	Right to left	Rear
CPU Enclosure processors	0/20, 0/21 1/20, 1/21 2/20, 2/21	Right to Left	Front
CPU Enclosure Memory Modules	0/0, 0/1, 0/2, 0/3 1/0, 1/1, 1/2, 1/3 2/0, 2/1, 2/2, 2/3	Right to Left	Front
CPU Enclosure Power Supplies	0/100 1/100 2/100		
CPU Enclosure Fans	0/110 1/110 2/110		
PCI Console Power Supplies	10/100 11/100 12/100 13/100		
PCI Console Fans	10/110 11/110 12/110 13/110		
Storage Enclosure Fans	40/110, 40/111, 40/112 41/110, 41/111, 41/112 42/110, 42/111, 42/112	Left to right	Rear
Storage Enclosure Power Supplies	40/100, 40/101 41/100, 41/101 42/100, 42/101	Left to right	Rear
Disk Drives	40/1, 40/2, 40/3, 40/4, 40/5, 40/6, 40/7, 40/8 41/1, 41/2, 41/3, 41/4, 41/5, 41/6, 41/7, 41/8 42/1, 42/2, 42/3, 42/4, 42/5, 42/6, 42/7, 42/8	Right to Left	Front

2.3.3 Level 3 Devices

Level 3 devices are ports on a PCI adapter. They are shown in the following table.

Level 3 Device	Possible Device IDs	Numbering Scheme	Viewed from (Front or Rear)
U460	10/3/?? 11/3/??	NA	
	10/1/1, 10/1/2, 10/1/3, 10/1/4 10/2/1, 10/2/2, 10/2/3, 10/2/4		

U403 Ports (4 ports)	11/1/1, 11/1/2, 11/1/3, 11/1/4 11/2/1, 11/2/2, 11/2/3, 11/2/4 12/0/1, 12/0/2, 12/0/3, 12/0/4 12/1/1, 12/1/2, 12/1/3, 12/1/4 12/2/1, 12/2/2, 12/2/3, 12/2/4 12/3/1, 12/3/2, 12/3/3, 12/3/4 13/0/1, 13/0/2, 13/0/3, 13/0/4 13/1/1, 13/1/2, 13/1/3, 13/1/4 13/2/1, 13/2/2, 13/2/3, 13/2/4 13/3/1, 13/3/2, 13/3/3, 13/3/4	Top to bottom	
U515 (1 port)	10/1/1, 10/2/1 11/1/1, 11/2/1 12/0/1, 12/1/1, 12/2/1, 12/3/1 13/0/1, 13/1/1, 13/2/1, 13/3/1	NA	
U516 (1 port)	10/1/1, 10/2/1 11/1/1, 11/2/1 12/0/1, 12/1/1, 12/2/1, 12/3/1 13/0/1, 13/1/1, 13/2/1, 13/3/1	NA	
U518 (2 ports)	10/0/1, 10/0/2 11/0/1, 11/0/2	Top to bottom	

2.3.4 Level 4 Devices

Level 4 devices include SCSI targets on a SCSI bus connected to a specific port on a specific PCI adapter.

Level 4 Device	Possible Device IDs	Numbering Scheme	Viewed from (Front or Rear)
Tape Drives	10/1/1/1, 10/1/1/1/2, 10/2/1/1, 10/2/1/1/2 11/1/1/1, 11/1/1/1/2, 11/2/1/1, 11/2/1/1/2 12/0/1/1, 12/0/1/1/2, 12/1/1/1, 12/1/1/1/2, 12/2/1/1, 12/2/1/1/2, 12/3/1/1, 12/3/1/1/2 13/0/1/1, 13/0/1/1/1, 13/1/1/1, 13/1/1/1/2, 13/2/1/1, 13/2/1/1/2, 13/3/1/1, 13/3/1/1/2		

All odd numbered CRUS/FRUS are powered by the A power strip (on left as viewed from rear of cabinet) and even numbered CRUS/FRUS are powered by the B power strip (on right as viewed from rear of cabinet) . Odd components have a shaded background on the label and even components have a white background.

2.3.5.1 Standard Configuration Device IDs for Disk Drives

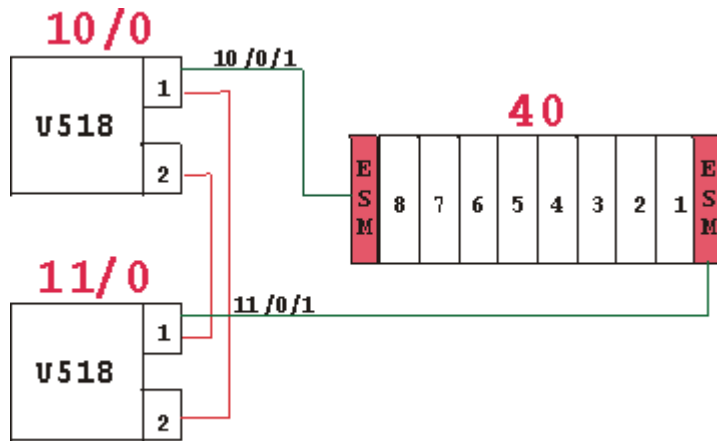
Split Bus - One Storage Enclosure

I/O enclosure ID	I/O enclosure Slot # ID	U518 Port # ID	Enclosure ID	Disk Device ID	Master/Slave Bus
10	10/0	10/0/1	10/0/1/40	10/0/1/40/1-4	Master
10	10/0	10/0/2	10/0/2/40	10/0/2/40/5-	Slave

				8	
11	11/0	11/0/1	11/0/1/40	11/0/1/40/5-8	Master
11	11/0	11/0/2	11/0/2/40	11/0/2/40/1-4	Slave

The following illustrates disk device IDs in a split bus configuration.

Figure 2-1. Split Bus Configuration

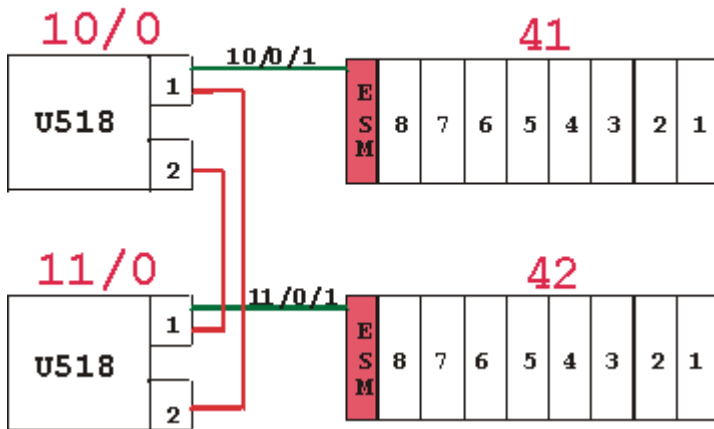


Joined (Straight) Bus - Two Storage Enclosures

I/O enclosure ID	I/O enclosure Slot # ID	U518 Port # ID	Enclosure ID	Disk Device ID	Master/Slave Bus
10	10/0	10/0/1	41	41/1-8	Master
10	10/0	10/0/2	42	42/1-8	Slave
11	11/0	11/0/1	42	42/1-8	Master
10	10/0	10/0/2	41	41/1-8	Slave

The following illustrates disk device IDs in a joined bus configuration.

Figure 2-2. Joined Bus Configuration



2.4 System Handling of Hardware Events

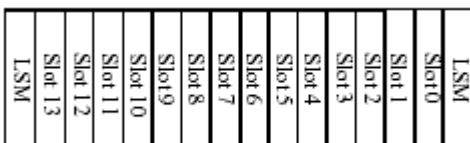
This section provides general information and guidelines for troubleshooting hardware failures in the ftServer system. For more information about monitoring and troubleshooting the system, refer to the *Stratus ftServer System Administrator's Guide* (R001W).

As shown in Figure 2-3, when a fault or some other event occurs at a hardware device, for example, a PCI card failure or an environmental monitor exceeding a threshold, the device driver notifies the ftServer Manager. If the ftServer Manager determines that the event is significant, as defined by the ftServer's Policy Service, it forwards the event notification to the Alarm Service for processing. The Alarm Service then forwards the notification as follows:

- Event information is recorded in the Windows 2000 Event Log.
- An alarm message is displayed on the front panel LCD.
- The user is notified by email or pager, depending on user configuration of the ftServer Manager.

In addition, ftServer Manager continuously copies the ftServer Windows 2000 Event Log to the ftServer Access Host Log on both ftServer Access adapters so that support personnel can retrieve the log in the event of a failure of the ftServer system.

Figure 2-3. Event Notification



2.5 Troubleshooting Failed Components

Use the ftSMC to accomplish tasks related to:

- Windows Not Responding
- Determining that a unit failed
- Taking a Component Offline

- Bringing a Component Online

2.5.1 Windows Not Responding

If the Windows 2000 operating system does not respond, that is, the system appears hung, use ftServer Access to reset or reboot. For information about using ftServer Access, see the *Stratus ftServer Access User's Guide* (R003W).

2.5.2 Determining that a unit failed

1. In **ftSMC**, expand the **System Inventory** by clicking the **ftServer** node in the Console tree and pressing the asterisk (*) key on the numeric keypad.
2. Look for **Warning** or **Error** icons. If you see a **Warning** icon, click on the plus sign (+) in front of nodes that have a **Warning** icon until you see an **Error** icon.

For example, **Warning** icons appear in these three nodes and the **Error** icon appears beside the SCSI Slot that has a problem, as follows:

Enclosure ID Drive Slot	0	1	2
Slot 0	3	18	33
Slot 1	4	19	34
Slot 2	5	20	35
Slot 3	6	21	36
Slot 4	7	22	37
Slot 5	8	23	38
Slot 6	9	24	39
Slot 7	10	25	40
Slot 8	11	26	41
Slot 9	12	27	42
Slot 10	13	28	43
Slot 11	14	29	44
Slot 12	15	30	45
Slot 13	16	31	46

3. Click on the problem node and check the MTBF: Current value in the **Details** pane. If it is less than the MTBF: Threshold value, that node has failed and the system takes it out of service. For example:

MTBF: Time of Last Fault May 30, 2000 15:07:24

MTBF: Threshold 300 seconds

MTBF: Number of Faults 2

MTBF: Current 220 seconds

2.5.3 Taking a Component Offline

1. In the **ftSMC** Console tree, select and right-click the failed component.
2. From the pop-up menu, select **Initiate Bring Down**. This results in shutting down the component.

NOTE: If the failed component is a mirrored disk, break the mirror before shutting the failed disk down.

3. If you are going to remove a disk, first confirm that the disk's mirror is present and functioning. If the mirror is present, go to Windows 2000 Disk Management and break the mirror. To break a mirror, right-click one of the disks and select **Break Mirror**.

To determine what disks are mirrored, go to Windows 2000 **Disk Management**. The logical disks that have the same drive letter are a mirrored pair. If the mirrors are set as Stratus recommends, then the disks in slots 1 and 5, 2 and 6, 3 and 7, and 4 and 8 are mirrors.

4. 4. If the component is a field-replaceable unit (FRU) or distributor-replaceable unit (DRU) remove the failed component and replace it with a new FRU or DRU. See Section 4A or Section 4B.
5. Bring the replaced component back online. See the next subsection.

2.5.4 Bringing a Component Online

1. In **ftSMC**, select and right-click the new component.
2. From the pop-up menu, click **Initiate Bring Up**. This results in bringing the component online.

2.6 Front Panel LCD Messages

The LCD (liquid crystal display) is located on the front panel of the system. The ftServer Access Console (ftSAC) displays the contents of the LCD. The LCD messages indicate the state of the system. When the system is running, ftServer Access handles the LCD display contents. When ftServer Manager is running, it handles the LCD display contents.

The following table describes the messages that appear in the LCD.

LCD Message	Description
Power Off	The host system power is off.
SYSTEM POST CODE: nnnn CPU N: IO n	The host system is running its BIOS. <i>nnnn</i> is the POST code value, <i>N</i> is a number that identifies the active CPU enclosure, and <i>n</i> is a number that identifies the active PCI chassis. For a description of each of the POST codes, refer to <i>Stratus ftServer Access User's Guide (R003W)</i> .
BIOS POST COMPLETE	After the BIOS has handed control to the boot loader, the LCD briefly displays this message.

CPU N: IO n	<i>N</i> is a number that identifies the active CPU enclosure, and <i>n</i> is a number that identifies the active PCI chassis.
BOOT LOADER CPU N: IO n	The host system has booted. <i>N</i> is a number that identifies the active CPU enclosure, and <i>n</i> is a number that identifies the active PCI chassis.
OS LOADING CPU N: IO n	The host operating system has started to load. <i>N</i> is a number that identifies the active CPU enclosure, and <i>n</i> is a number that identifies the active PCI chassis.
OS UP CPU N: IO n	The host operating system has successfully loaded. <i>N</i> is a number that identifies the active CPU enclosure, and <i>n</i> is a number that identifies the active PCI chassis.
System_name IP_Address	ftServer Manager is running and the system is in normal operation. <i>System_name</i> indicates the name of the host system, <i>IP_Address</i> specifies the system's primary IP address, and a spinner indicates that the system is running.
ftSA Gateway Driver Up	The ftSA Gateway driver, an interface between the ftServer Access PCI Adapter and the host system operating system, is running.
ERROR Error_description	ftServer Access detected an error, for example, a failure to run a normal (fault-resilient) boot. <i>Error_description</i> is text that describes the error.
SYSTEM CRASH State Sensitive Recovery	ftServer Access detected a system crash and is running a state sensitive recovery.
Previous_message Alarm_message -or- IP_Address	ftServer Manager detected a system error condition. <i>Previous_message</i> is the message displayed before the error condition occurred. <i>Alarm_message</i> is text that describes the error and indicates the the device ID of the component that committed the error. Alarm messages indicate failures of components such as a CPU or memory board; disk; fan or power supply; ftServer Access, host Ethernet, and SCSI connector; I/O bus; ftServer Manager software; or another connector. The alarm message text alternates with <i>IP_Address</i> , the system's primary IP address; a spinner indicates that the system is running. The capacity of the LED is 24 characters; as a result, the alarm message text scrolls continuously to display the full message. The LCD displays an alarm message until you use the ftServer Management Console to dismiss it.

The LCD displays only the most recent alarm message. If a second alarm condition occurs prior to the user dismissing the first, the second alarm message replaces the first on the LCD.

3A. FRU Hardware Removal and Replacement Procedures

This section lists the Field Replaceable Units (FRUs) in the ftServer 5200 system and describes the removal and replacement procedures for each one. In most instances, FRUs are duplexed and may be removed and replaced without total removal of power, and thus, without loss of continuous processing. However, in some instances, the system must be shut down and both main power switches turned off prior to removal and replacement of the FRU.

3A.1 List of FRUs

The following table lists the FRUs in the ftServer 5200 system.

Component	Part Number
Storage Enclosure	AA-D52000
Repeater-Enclosure Services Module (R-ESM)	AA-E51100
Memory Module	AA-M22100/M22300/M22200
Voltage Regulator Module (VRM)	TA-000103
Processor	AS-000380
ftServer Access Adapter 56K Modem	AA-C51900
I/O Terminator Module	AA-E51200
Power Strip	AA-P41100/P41101
Fibre Channel RAID Enclosure	AA-D57000/AA-D58000

3A.2 Power Removal

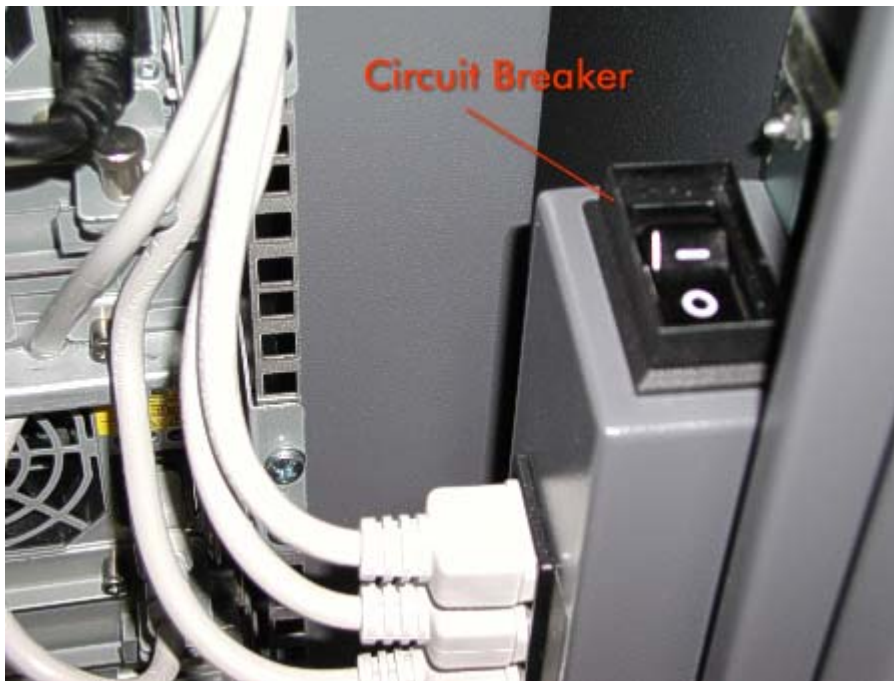
If total power removal is required, the system must be shut down prior to removing power and rebooted after the replacement unit is installed. Refer to Section 2 for the shutdown procedure.

Power is removed from one side of the system by turning off the circuit breaker at the top of the power strip(s) on that side of the cabinet as shown in Figure 3A-1. This will simplex the system. If the system must be powered down completely, turn off the circuit breakers on both sides.

(See Figure 3A-1)

CAUTION: If the system needs to be simplexed (power removed from one side of the cabinet), verify that there are no red LEDs or system messages indicating a failed duplexed component on the side of the system that will remain powered on. If both components in a duplexed pair are removed, a system crash will occur.

Figure 3A-1. Power Strip Circuit Breaker



3A.3 Hardware Removal Procedures

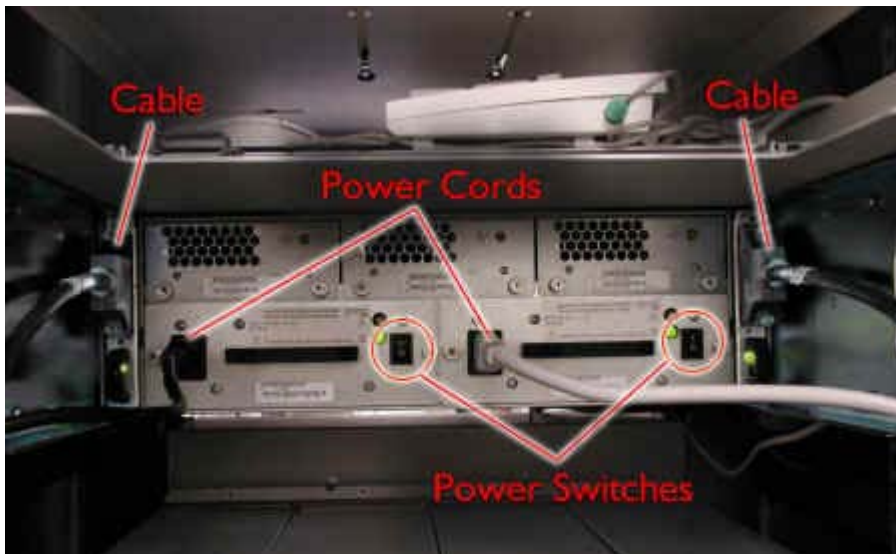
This section contains the removal procedures for the FRUs listed in the preceding table. Each of these procedures indicates any power removal requirements for the FRU. If a customer replaceable unit (CRU) needs to be removed during the procedure, it is designated as a CRU. If necessary, refer to *ftServer 5200 Operation and Maintenance Guide* (R459) for its removal procedure.

To perform the replacement procedure for each FRU, reverse the removable procedure. If any special replacement considerations are necessary, a replacement note is included.

3A.3.1 Storage Enclosure (AA-D51001)

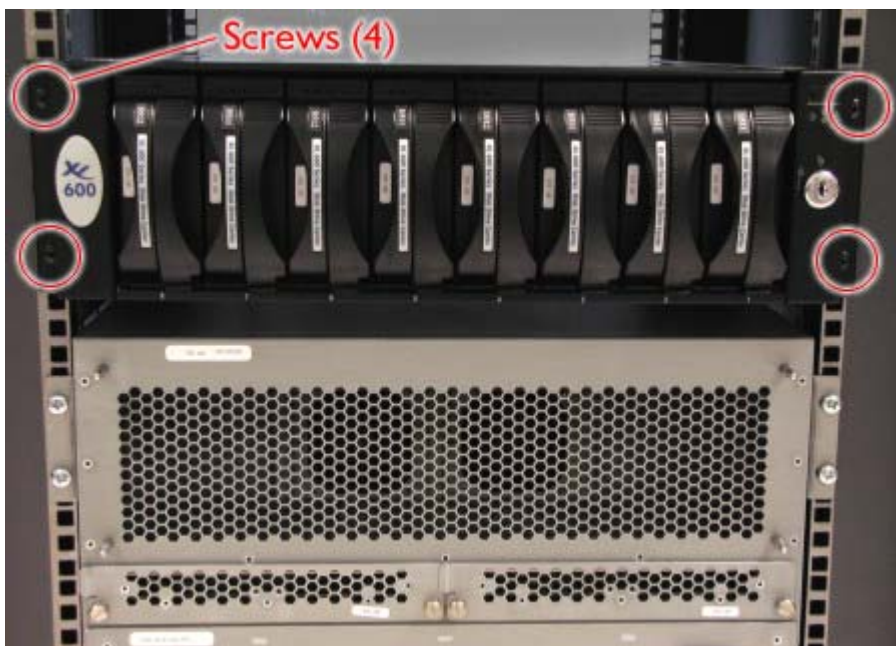
1. Turn off the power switches on the rear of the storage enclosure. (Figure 3A-2)
2. Disconnect the cables on the I/O Terminator and/or R-ESMs.
3. Disconnect the power cords from the rear of the enclosure.

Figure 3A-2. Storage Enclosure Power Switches



4. Remove the four screws securing the enclosure at the front of the cabinet. (Figure 3A-3)

Figure 3A-3. Storage Enclosure Screws

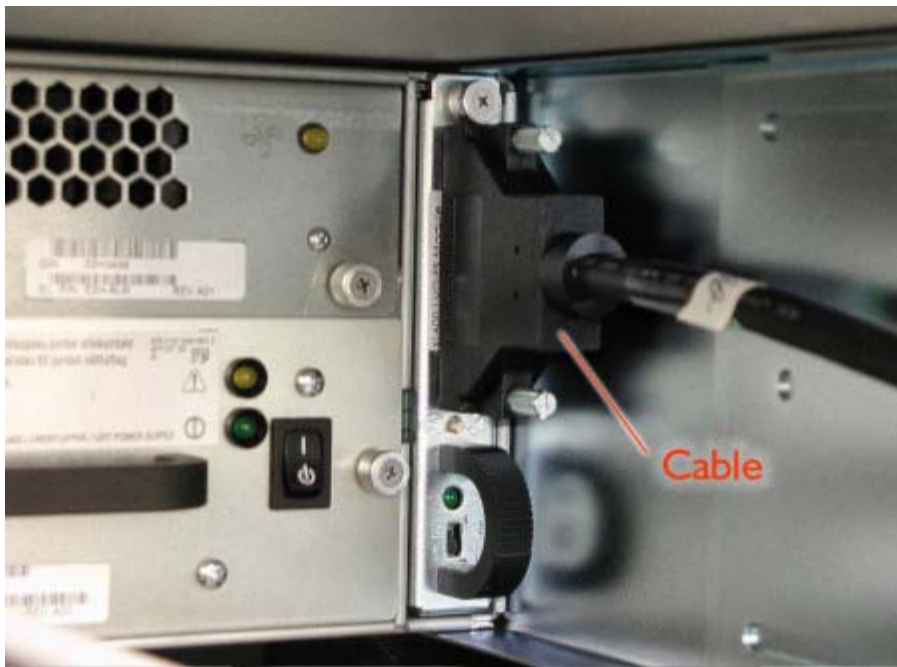


5. Carefully slide the enclosure out of the front of the cabinet.

3A.3.2 Repeater-Enclosure Services Module (R-ESM) (AA-E5110)

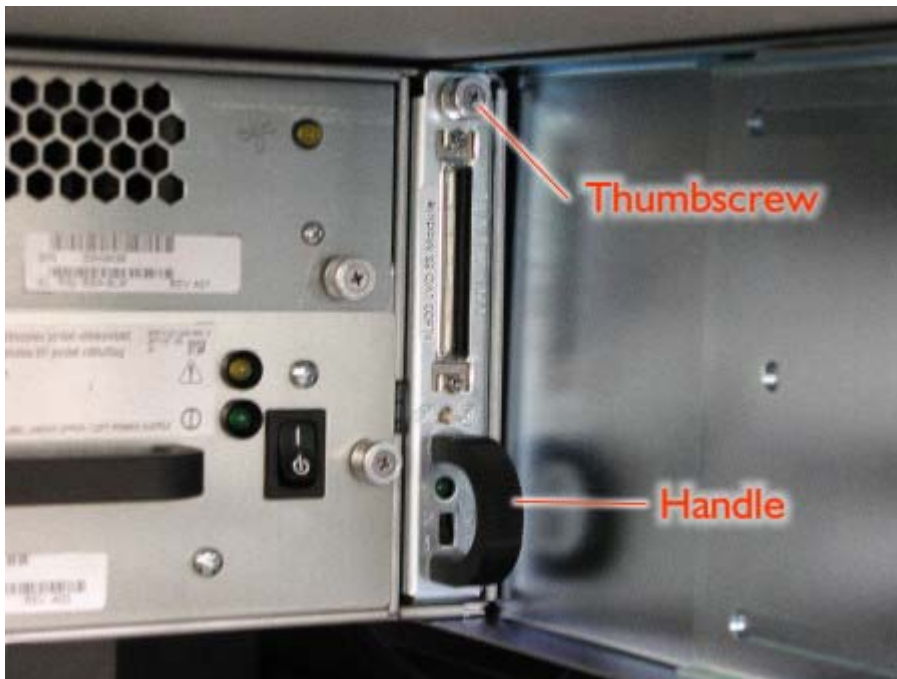
1. At the rear of the cabinet, remove the cables connected to the R-ESM at the rear of the storage enclosure. (Figure 3A-4)

Figure 3A-4. R-ESM Cables



2. Loosen the thumbscrew that secures the R-ESM in place. (Figure 3A-5)
3. Grasp the handle on the R-ESM and slowly pull the R-ESM out of the storage enclosure.

Figure 3A-5. R-ESM Thumbscrew



Make sure the switch on the replacement R-ESM is set the same as on the faulty R-ESM. (Figure 3A-6)

Figure 3A-6. R-ESM Switch

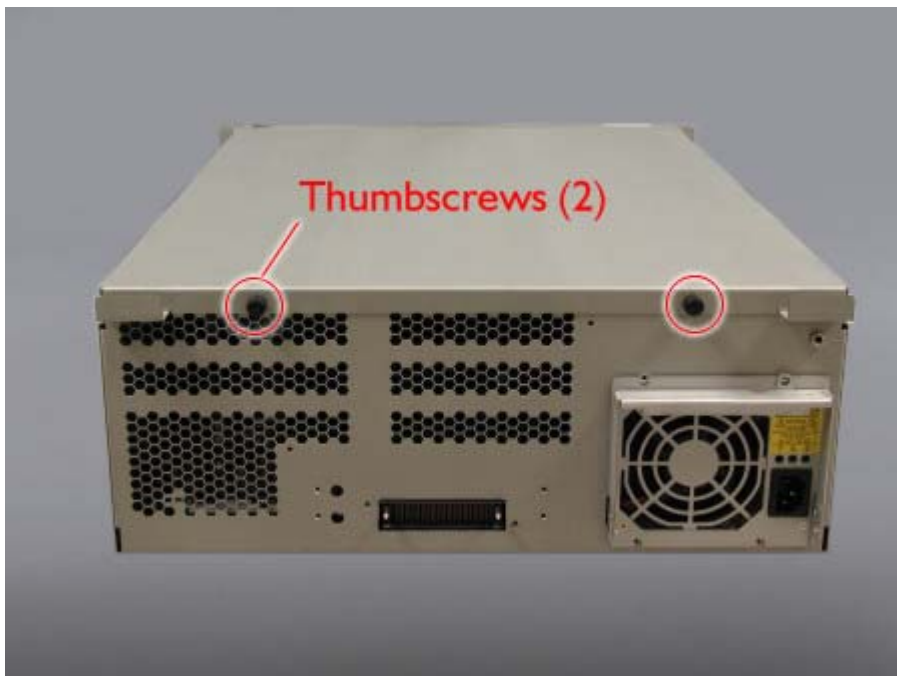


3A.3.3 Memory Module (AA-M22100/M22300/M22200)

Remove the CPU Enclosure (CRU).

1. Loosen the two thumbscrews securing the cover at the rear of the CPU Enclosure and remove the cover. (Figure 3A-7)

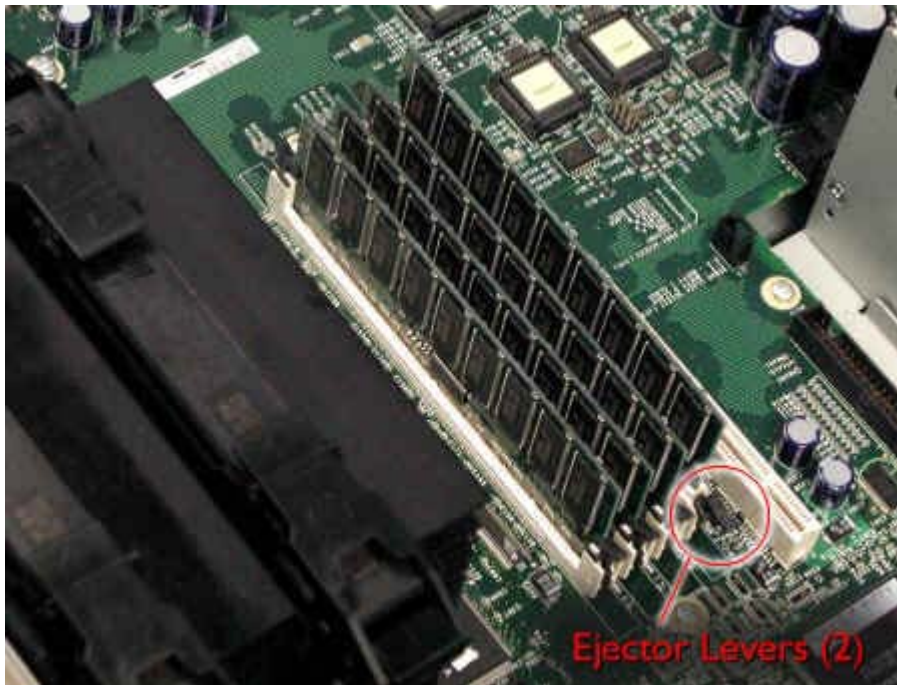
Figure 3A-7. CPU Enclosure Screws



2. Release the Memory Module's ejector levers and pull the module straight out from the connector. (Figure

3A-8)

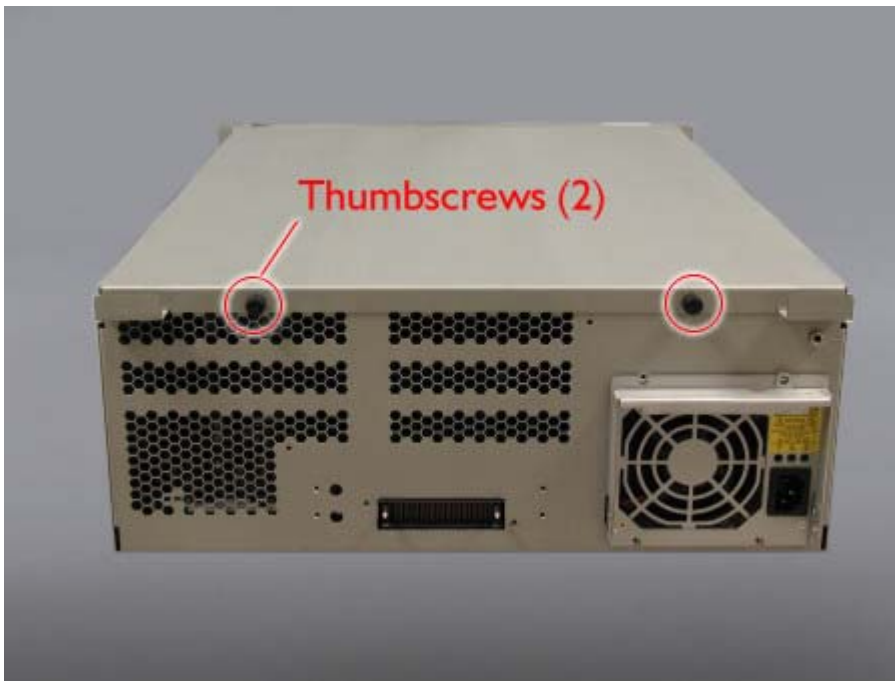
Figure 3A-8. Memory Module Ejector Levers



3A.3.4 Voltage Regulator Module (VRM) (TA-000103)

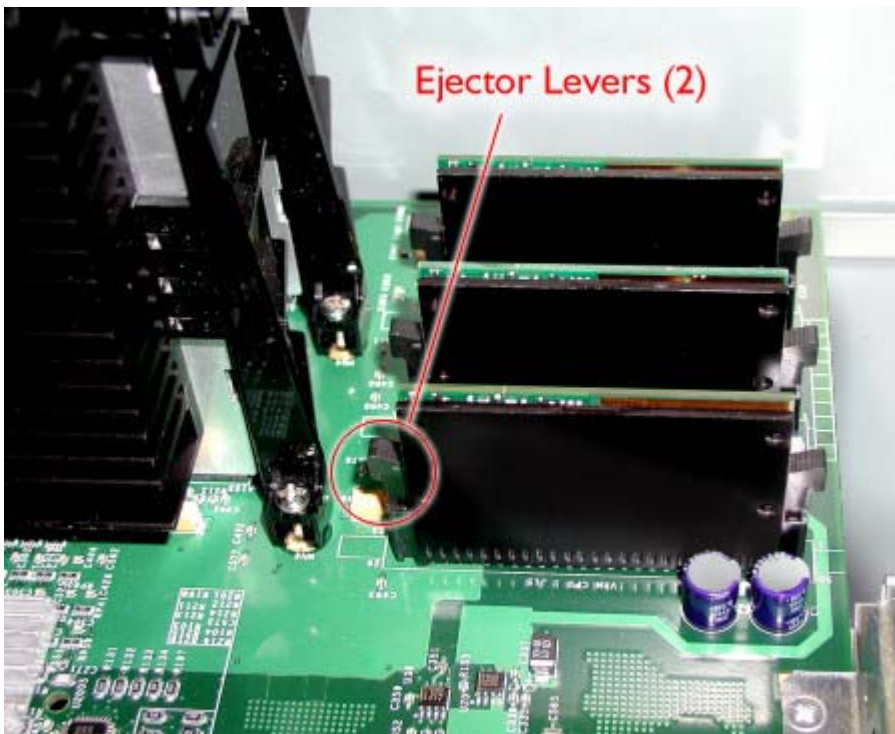
1. Remove the CPU Enclosure (CRU).
2. Loosen the two thumbscrews securing the cover at the rear of the CPU Enclosure and remove the cover. (Figure 3A- 9)

Figure 3A-9. CPU Enclosure Screws



3. Release the VRM's ejector levers and pull the VRM straight out from the connector. (Figure 3A- 10)

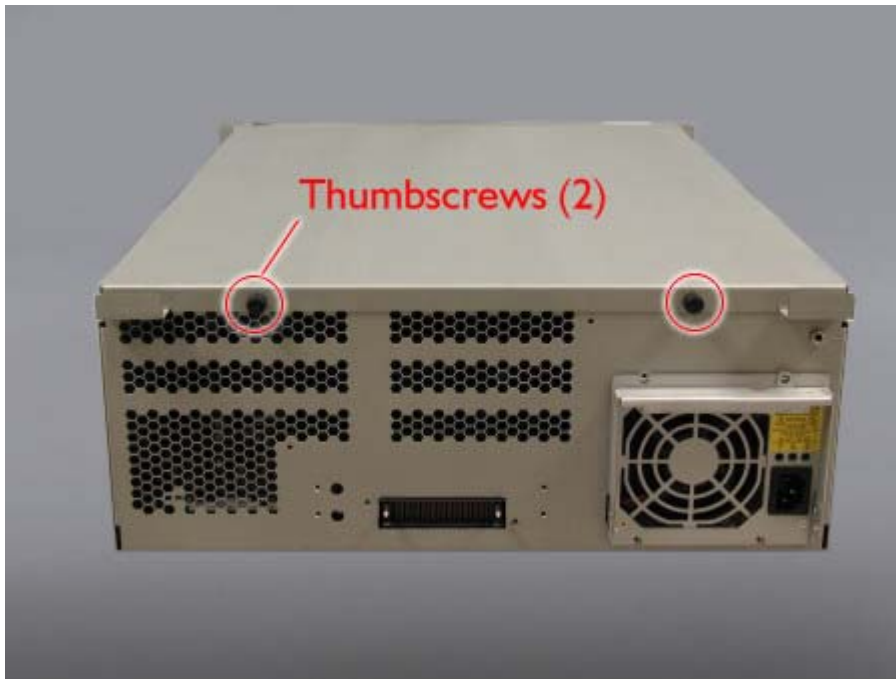
Figure 3A-10. VRM Ejector Levers



3A.3.5 Processor (UP-P3X512-550)

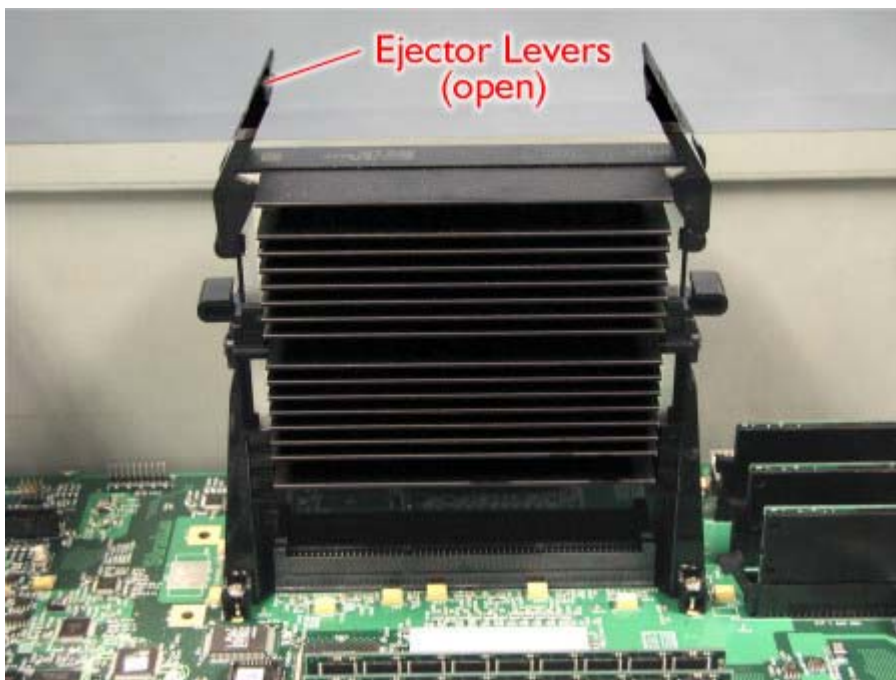
1. Remove the CPU Enclosure (CRU).
2. Loosen the two thumbscrews securing the cover at the rear of the CPU Enclosure and remove the cover. (Figure 3A-11)

Figure 3A-11. CPU Enclosure Screws



3. Release the Processor's ejector levers and pull the Processor straight up and out from the connector. (Figure 4-12)

Figure 3A-12. Processor Ejector Levers



3A.3.6 ftServer Access Adapter 56K Modem (AA-C51900)

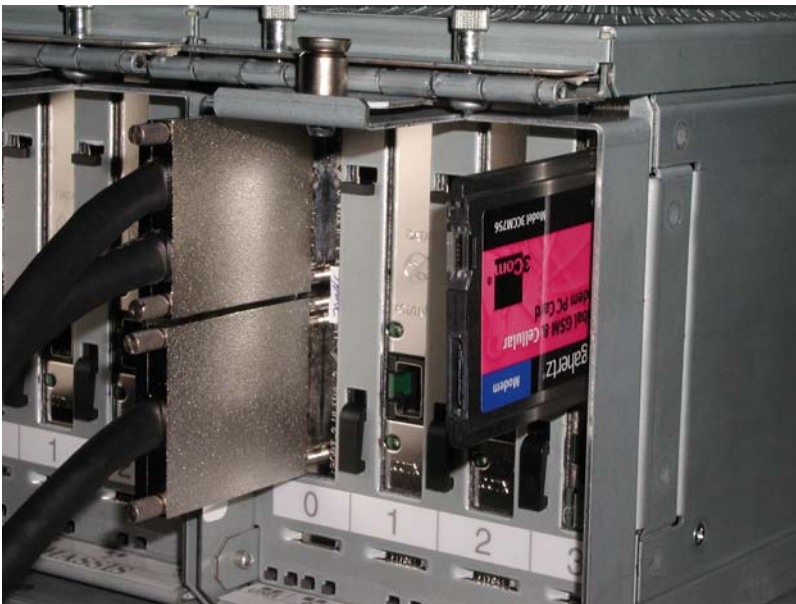
1. At the rear of the cabinet, disconnect the modem cable from the modem. (Figure 3A-13)

Figure 3A-13. Modem Cable



2. Remove the modem by pulling it straight out of its slot on the ftServer Access Module. (Figure 3A-14)

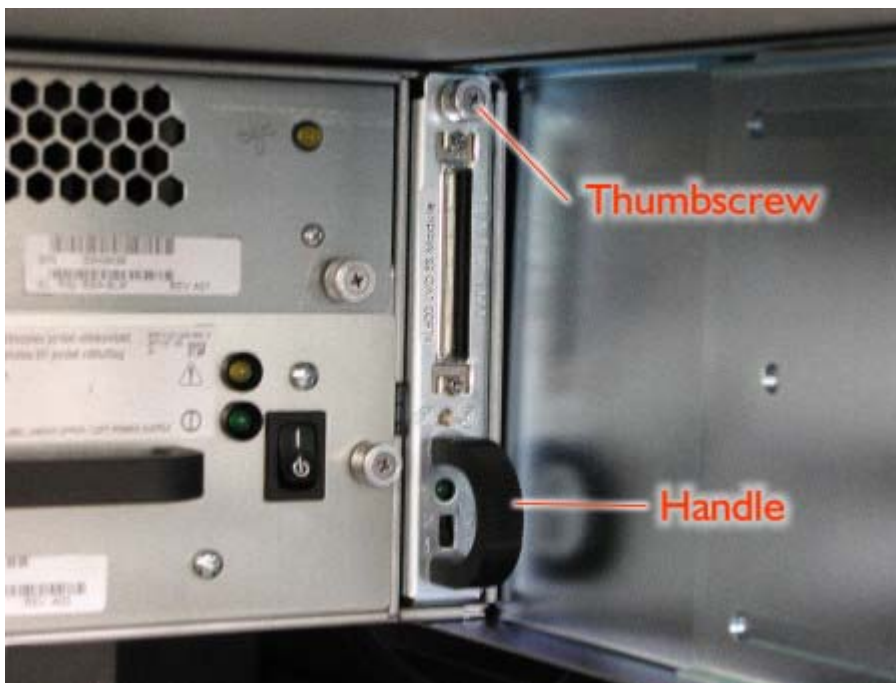
Figure 3A-14. Removing the Modem



3A.3.7 I/O Terminator Module (AA-E51200)

1. At the rear of the cabinet, loosen the thumbscrew that secures the I/O terminator in place. (Figure 3A-15)
2. Grasp the handle on the I/O terminator and slowly pull it out of the storage enclosure.

Figure 3A-15. I/O Terminator Thumbscrew



Make sure the switch on the replacement I/O terminator is set the same as on the faulty one. (Figure 3A-16)

Figure 3A-16. I/O Terminator Switch



3A.3.8 Power Strip

1. At the rear of the cabinet turn off the failed power strip. (Figure 4A-17)
2. Disconnect the power cord from bottom of the power strip.
3. Remove the four nuts securing the power strip to the mounting screws on the side of the cabinet.

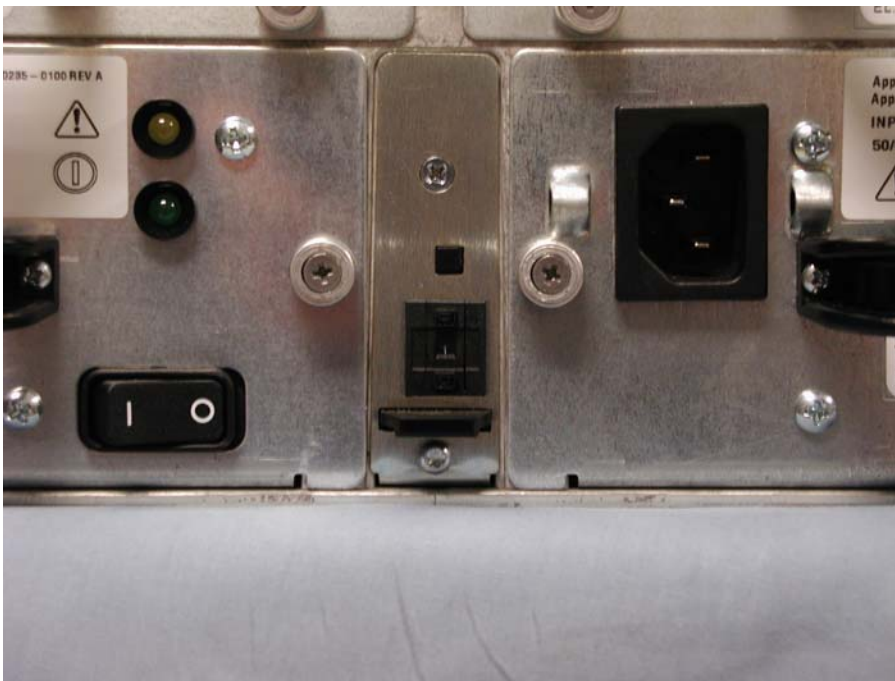
Figure 4A-17. Power Strip Nuts

3A.3.9 Fibre Channel RAID Enclosure

1. Remove the Fibre Channel RAID subsystem from the cabinet. (CRU)
2. Remove the following CRUs from the enclosure:
 - Disk Drives
 - I/O Modules or RAID Controllers
 - LS Modules
 - Power Supply Modules
 - Fan Modules

REPLACEMENT NOTE: Make sure the ID switch on the replacement enclosure is set to the same enclosure ID as the failed enclosure (0 for D570; 1 or 2 for D580). See figure 4A-18. The enclosure ID must be set before the Fibre Channel enclosure is powered on.

Figure 4A-18. Enclosure ID Switch.



3B. DRU Hardware Removal and Replacement Procedures

This section lists the Distributor Replaceable Units (DRUs) in the ftServer 5200 system and describes the removal and replacement procedures for each one. In some instances, DRUs are duplexed and may be removed and replaced without total removal of power, and thus, without loss of continuous processing. However, in most instances, the system must be shut down and both main power switches turned off prior to removal and replacement of the DRU.

3B.1 List of DRUs

The following table lists the DRUs in the ftServer 5200 system. It shows the location of each DRU.

Component	Part Number	Location
CPU Motherboard	AA-G10000	CPU Enclosure
LVDS I/O Power and Distribution Board	AA-E83000	PCI Console Shelf
Peripheral Bus Interconnect	AA-E15300	Front Panel
IDE Bus	AA-E15600	Front Panel
High-capacity Disk Drive	AA-D56000	Front Panel
CD-ROM Drive	AA-D55000	Front Panel
Backup Battery Unit (BBC)	AA-D58100	Fibre Channel Enclosure

3B.2 Power Removal

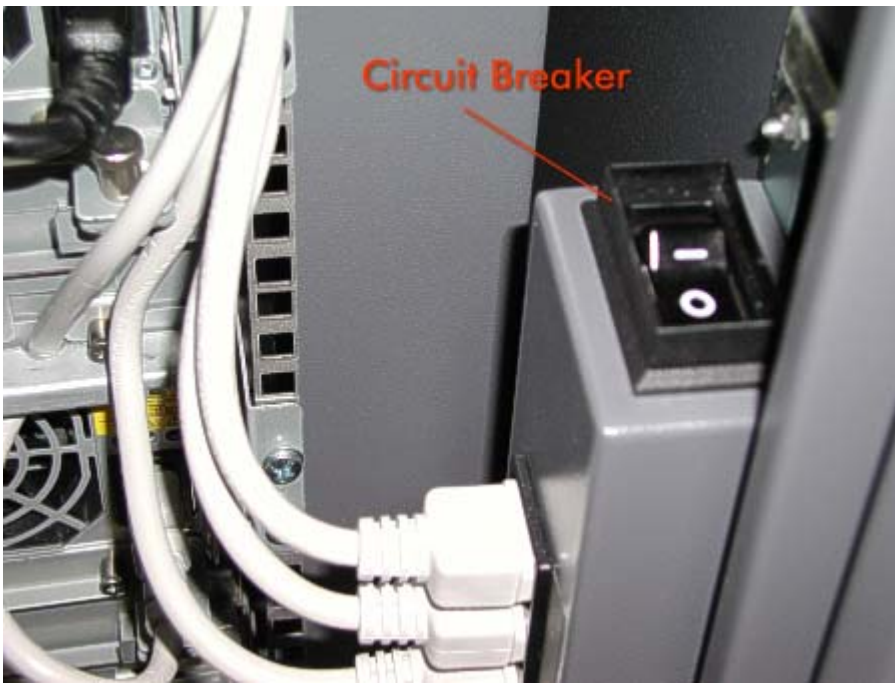
If total power removal is required, the system must be shut down prior to removing power and rebooted after the replacement unit is installed. Refer to Section 2 for the shutdown procedure.

Power is removed from one side of the system by turning off the circuit breaker at the top of the power strip(s) on that side of the cabinet as shown in Figure 4A-1. This will simplex the system. If the system must be powered down completely, turn off the circuit breakers on both sides.

(See Figure 3B-1)

CAUTION: If the system needs to be simplex (power removed from one side of the cabinet), verify that there are no red LEDs or system messages indicating a failed duplexed component on the side of the system that will remain powered on. If both components in a duplexed pair are removed, a system crash will occur.

Figure 3B-1. Power Strip Circuit Breaker



3B.3 Hardware Removal Procedures

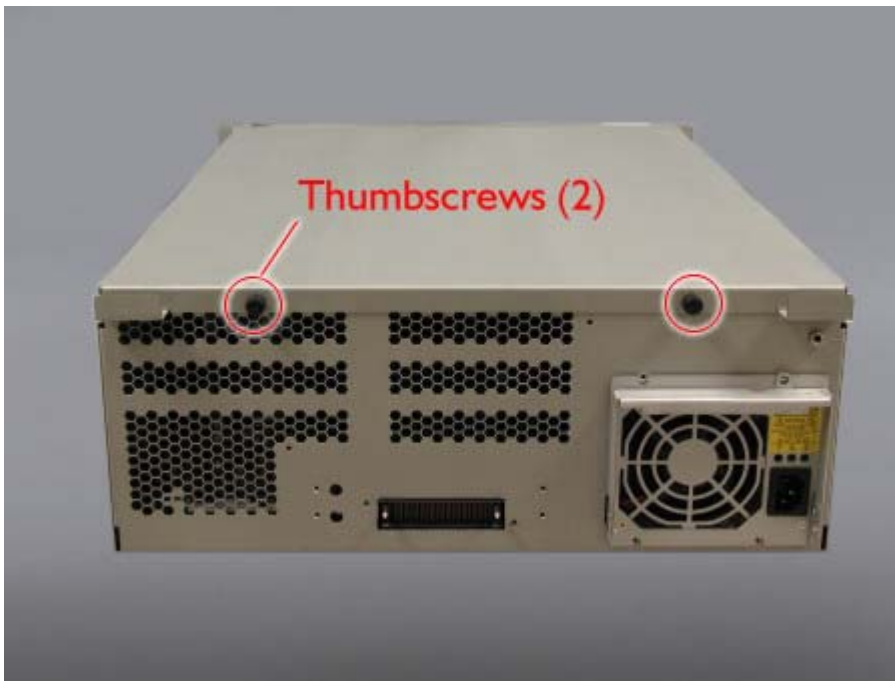
This section contains the removal procedures for the DRUs listed in the preceding table. Each of these procedures indicates any power removal requirements for the DRU. If a Field Replaceable Unit (FRU) needs to be removed during the procedure, it is designated as a FRU. If necessary, refer to Section 4A in this manual. If a customer replaceable unit (CRU) needs to be removed during the procedure, it is designated as a CRU. If necessary, refer to *fiServer 5200 Operation and Maintenance Guide* (R459) for its removal procedure.

To perform the replacement procedure for each DRU, reverse the removable procedure. If any special replacement considerations are necessary, a replacement note is included.

3B.3.1 CPU Motherboard (AA-G10000)

1. Remove the CPU Enclosure (CRU).
2. Loosen the two thumbscrews securing the cover at the rear of the CPU Enclosure and remove the cover. (Figure 3B-2.)

Figure 3B-2. CPU Enclosure Screws



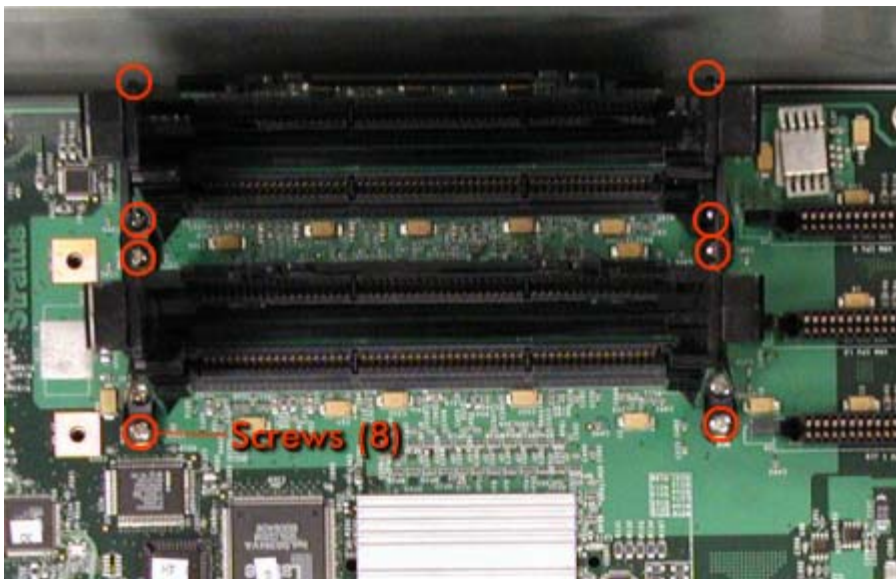
3. Remove the processors, memory modules, and voltage regulators. (Refer to Sections x, y, and z for removal procedures.)
4. Remove the 14 screws securing the motherboard. (Figure 3B-3.)

Figure 3B-3. Motherboard Screws



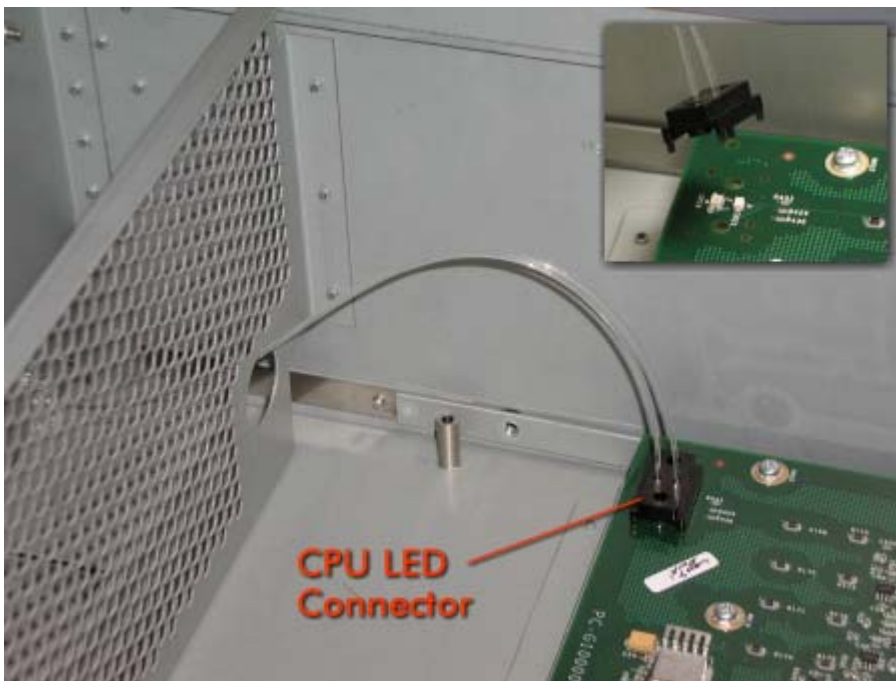
5. Remove the eight screws securing the processor holders to the motherboard and then remove the holders.

Figure 3B-4. Processor Holder Screws (M16)



6. Remove the CPU LED connector by pulling it straight up out of the motherboard. (Figures 3B- 5)

Figure 3B-5. CPU LED Connector

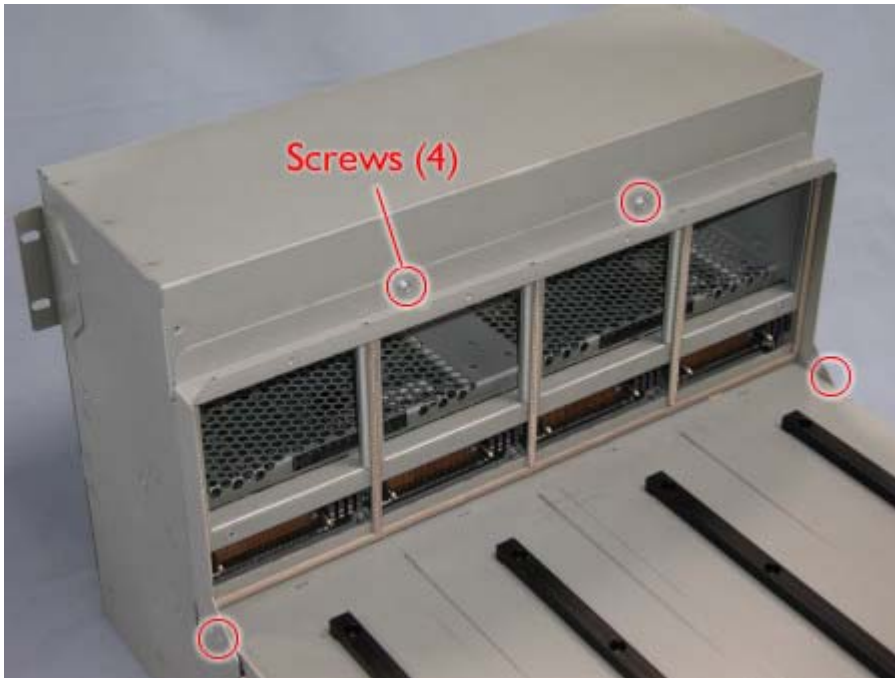


7. Remove the CPU enclosure fans (CRU).
8. Carefully lift the motherboard out of the CPU enclosure.

3B.3.2 LVDS I/O Power and Distribution Board (AA-E83000)

1. At the rear of the cabinet, remove the PCI power supplies (CRUs) from the PCI console shelf.
2. Remove the PCI console shelf and place it on a flat surface. (See [Section 3B.3.7](#) for removal procedure.)
3. Remove the filler panels from the expansion I/O enclosure slots.
4. Remove the four screws securing the EMI shield. (two of the screws are on the side). (Figure 3B-6.)

Figure 3B-6. EMI Shield Screws



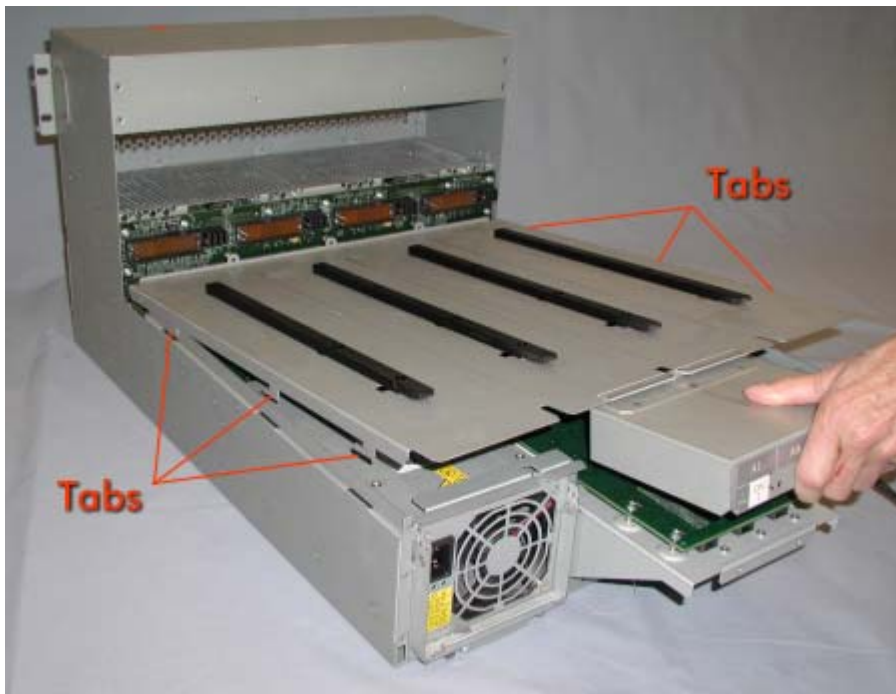
5. Remove the clock cards (CRUs).
6. Remove the five screws securing the cover over the LVDS I/O Power and Distribution Board. (Two of the screws are on the CPU-to-PCI cable cover.) (Figure 3B-7.)

Figure 3B-7. LVDS I/O Power and Distribution Board Cover Screws



7. Slide the cover slightly toward the rear to release the tabs and then carefully lift it off. (Figure 3B-8.)

Figure 3B-8. Removing the LVDS I/O Power and Distribution Board Cover



8. Remove the 26 screws securing the LVDS I/O Power and Distribution Board. (Figure 3B-9.)

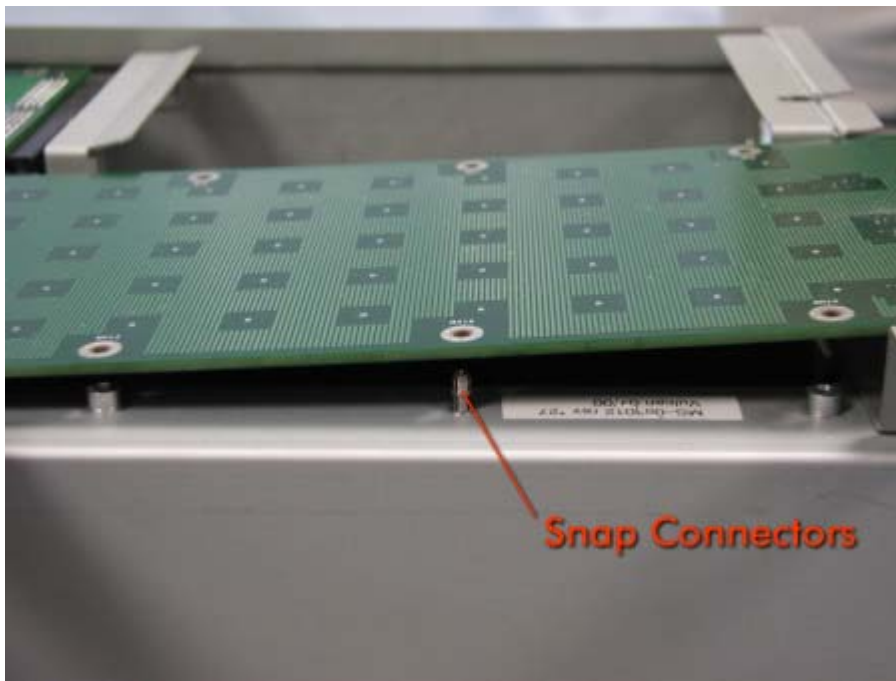
NOTE: The four screws over the CPU-PCI cable connectors are longer than the others.

Figure 3B-9. LVDS I/O Power and Distribution Board Screws



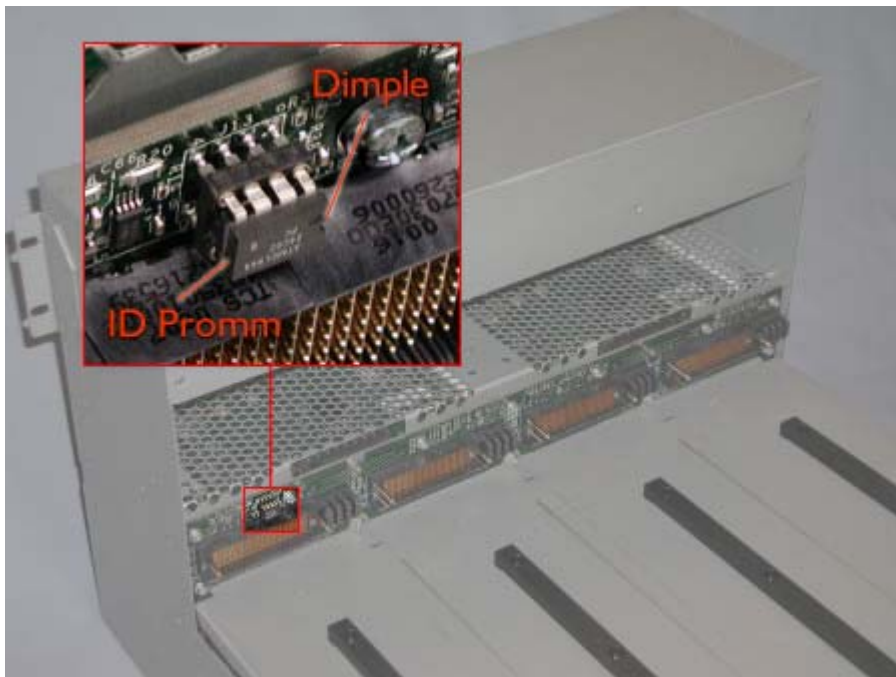
9. Carefully pull the LVDS I/O Power and Distribution Board up and off the two snap connectors and then remove it ((Figure 3B-10.)

Figure 3B-10. Removing the LVDS I/O Power and Distribution Board



10. Remove the ID PROM as follows and install it on the replacement LVDS I/O Power and Distribution Board prior to installing the board.
 - a. Note the orientation of the ID PROM on the faulty LVDS I/O Power and Distribution Board because it will have to be inserted exactly the same way on the replacement board. (The dimple in the upper right hand corner is on pin 1.) (Figure 3B-11)

Figure 3B-11. ID PROM



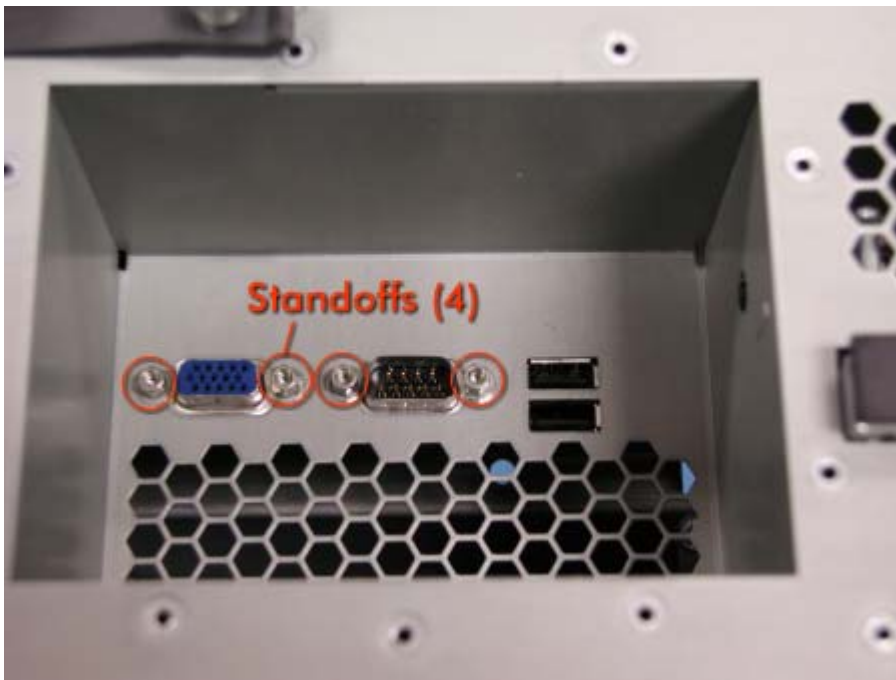
CAUTION: The pins on the ID PROM bend very easily.

- b. Very carefully pull the ID PROM straight out of its socket, being careful not to bend its pins.
- c. Install the ID PROM on the replacement board, making sure you install it in the same orientation as it was on the faulty board.

3B.3.3 Peripheral Bus Interconnect PCB (AA-E15300)

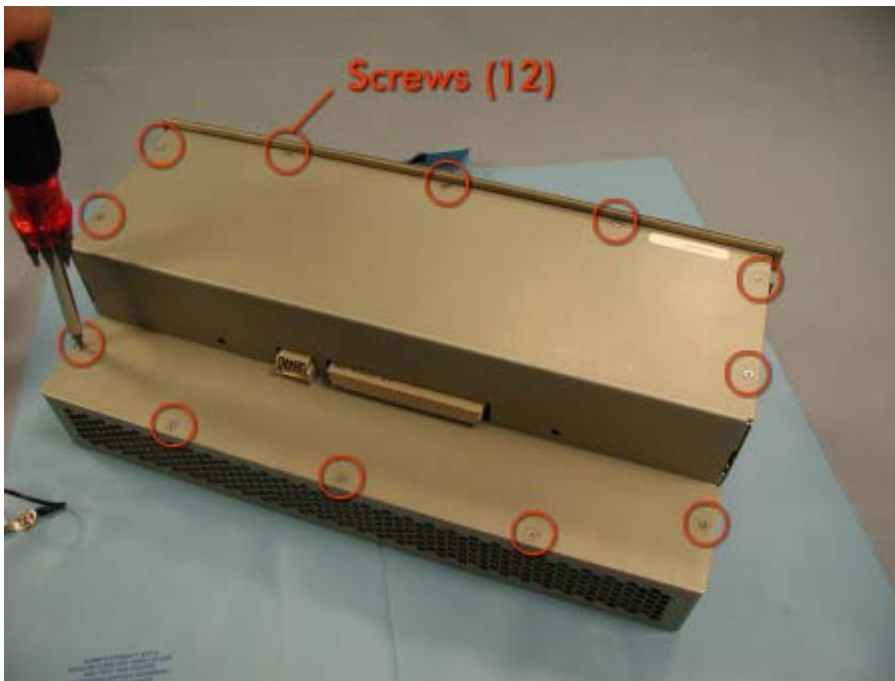
1. Remove the Front Panel (CRU).
2. At the front of the Front Panel remove the standoffs from the connectors. (Figure 3B-12.)

Figure 3B-12. Front Panel Standoffs



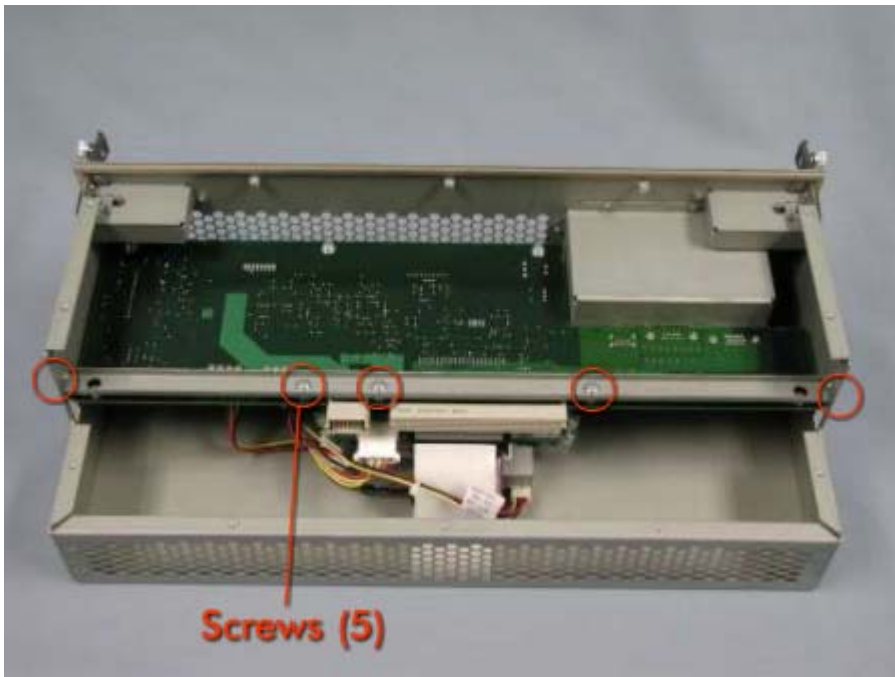
3. Remove the 12 screws securing the Front Panel cover. (Figure 3B-13.)

Figure 3B-13. Front Panel Cover Screws



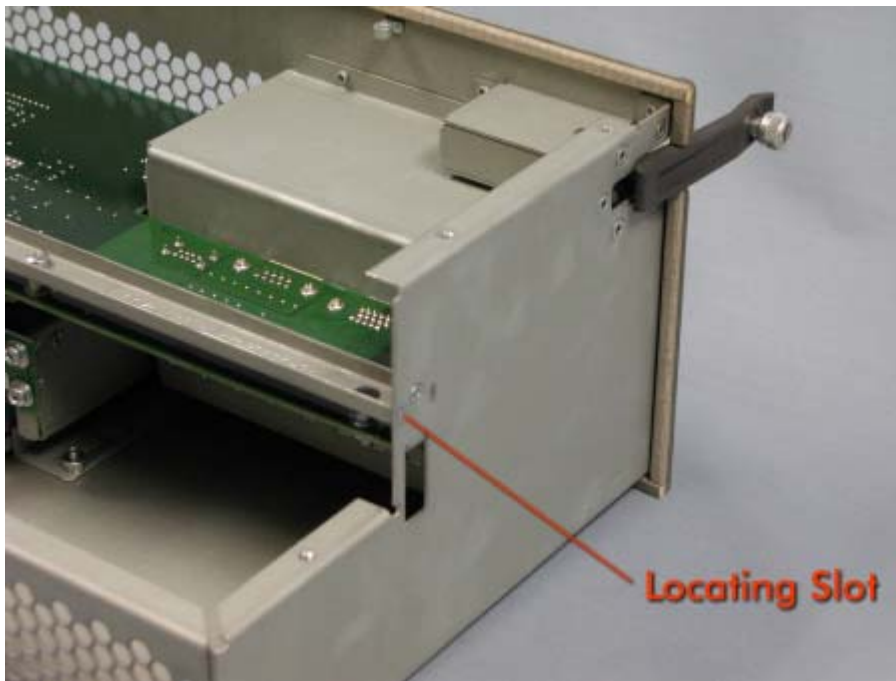
4. Remove the five screws securing the Peripheral Bus Interconnect PCB stiffener (two are on the sides of the Front Panel). (Figure 3B-14.)

Figure 3B-14. Peripheral Bus Interconnect PCB Stiffener Screws



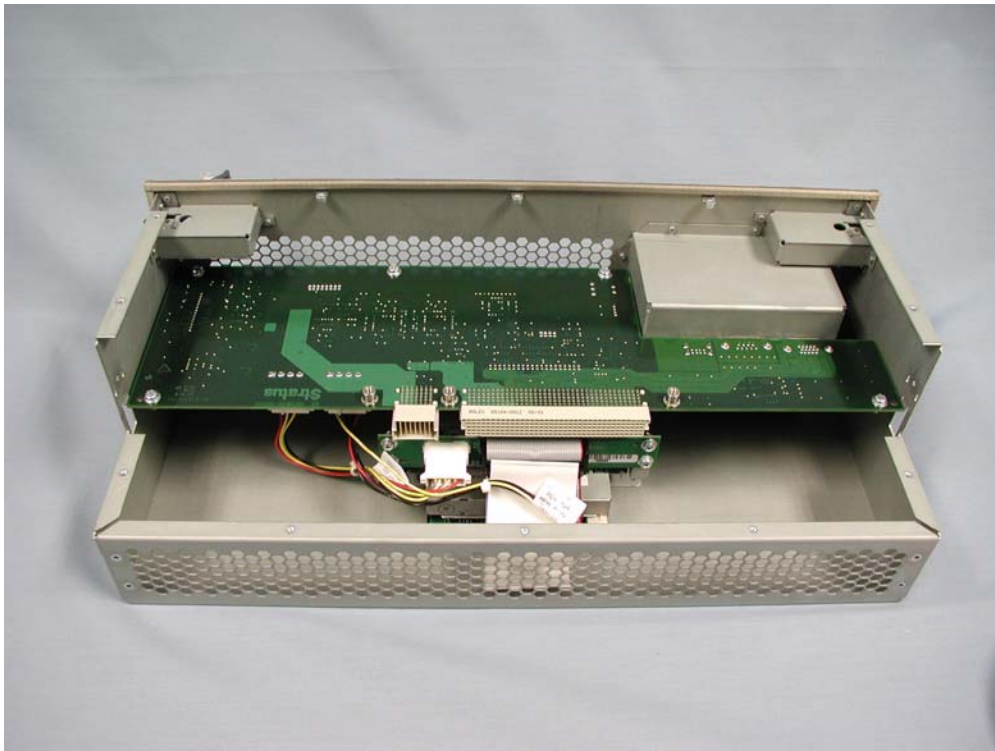
5. Pull the tabs on the board stiffener out of the locating slots on the Front Panel sides. Carefully remove the stiffener. (Figure 3B-15.)

Figure 3B-15. Peripheral Bus Interconnect PCB Stiffener Tabs



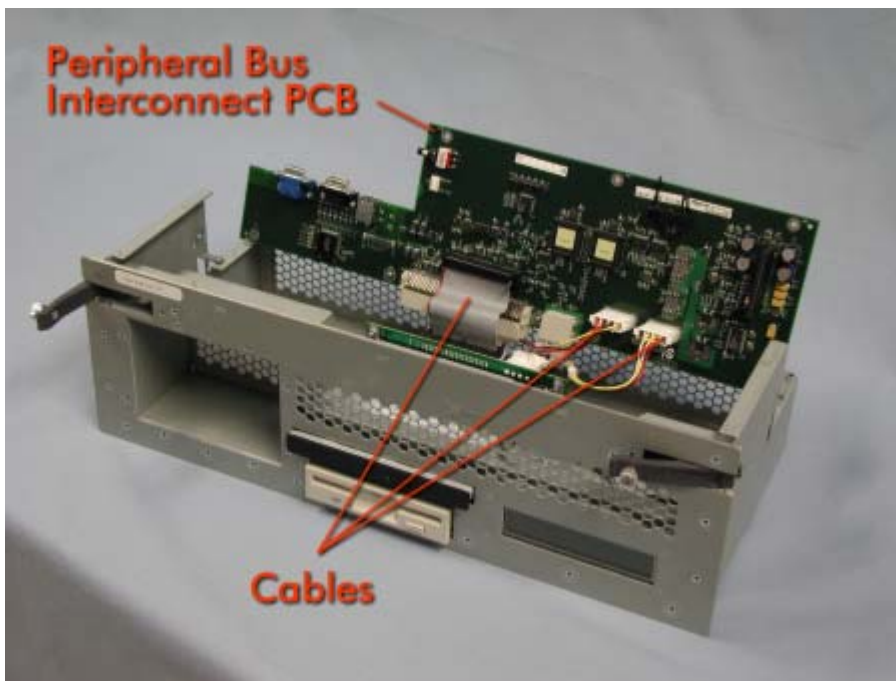
6. Remove the seven screws securing the Peripheral Bus Interconnect PCB. (Figure 3B-16.) (M10)

Figure 3B-16. Peripheral Bus Interconnect PCB Screws



7. Carefully turn the Peripheral Bus Interconnect PCB upward and disconnect all the cables from it. (Figure 3B-17)

Figure 3B-17. Peripheral Bus Interconnect PCB Cables

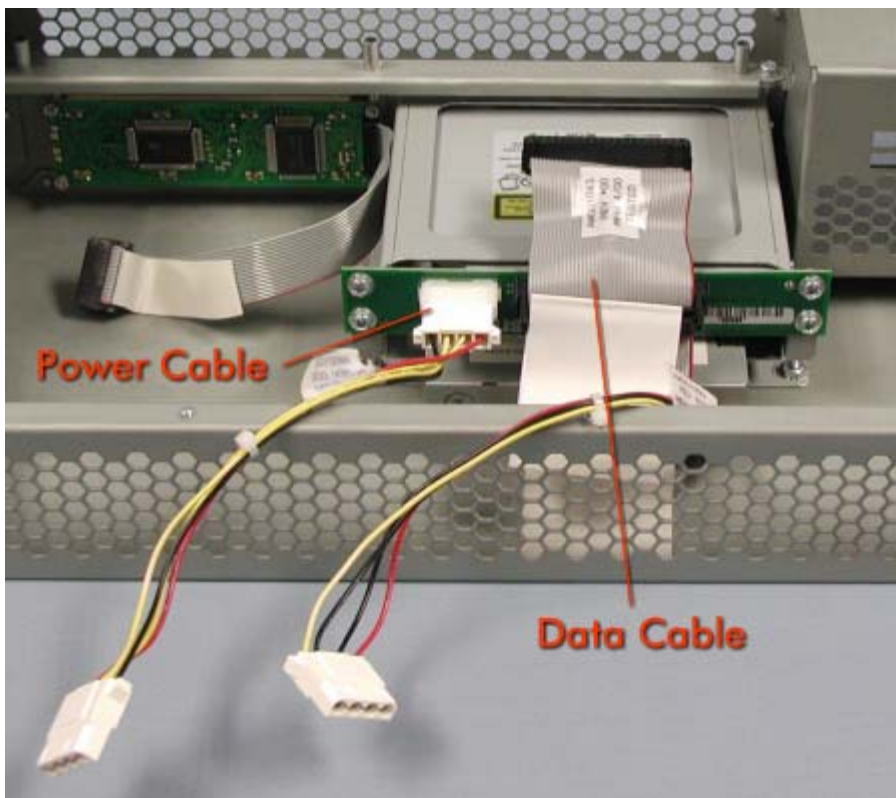


8. Carefully lift the Peripheral Bus Interconnect PCB out of the Front Panel.

4.B.3.4 IDE Bus PCB (AA-E15600)

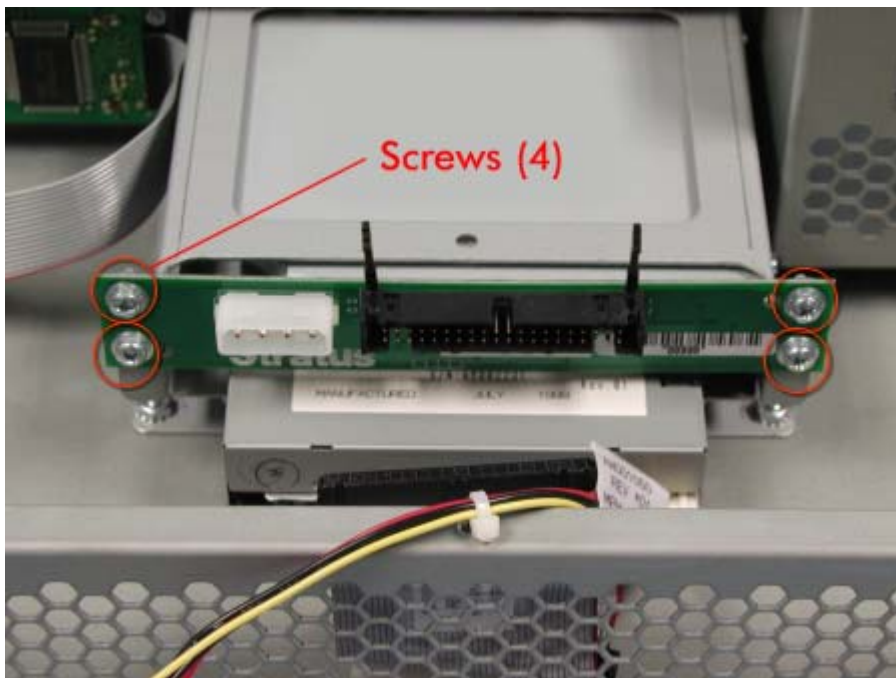
1. Remove the Front Panel (CRU).
2. Remove the Peripheral Bus Interconnect PCB. (See Section 4.5.10 for removal procedure.)
3. Disconnect the data and power cables from the IDE Bus PCB. (Figure 3B-18)

Figure 3B-18. IDE Bus PCB Cables



4. Remove the four screws securing the IDE Bus PCB. (Figure 3B-19)

Figure 3B-19. IDE Bus PCB Screws



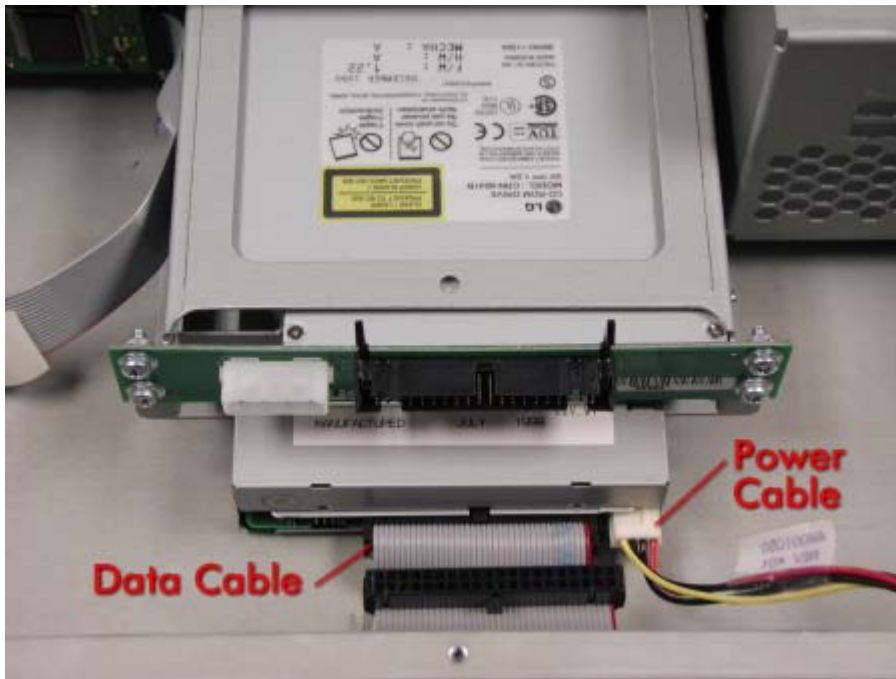
5. Carefully lift the IDE Bus PCB out of the Front Panel.

3B.3.5 High-capacity Disk Drive AA-D56000)

1. Remove the Front Panel (CRU).

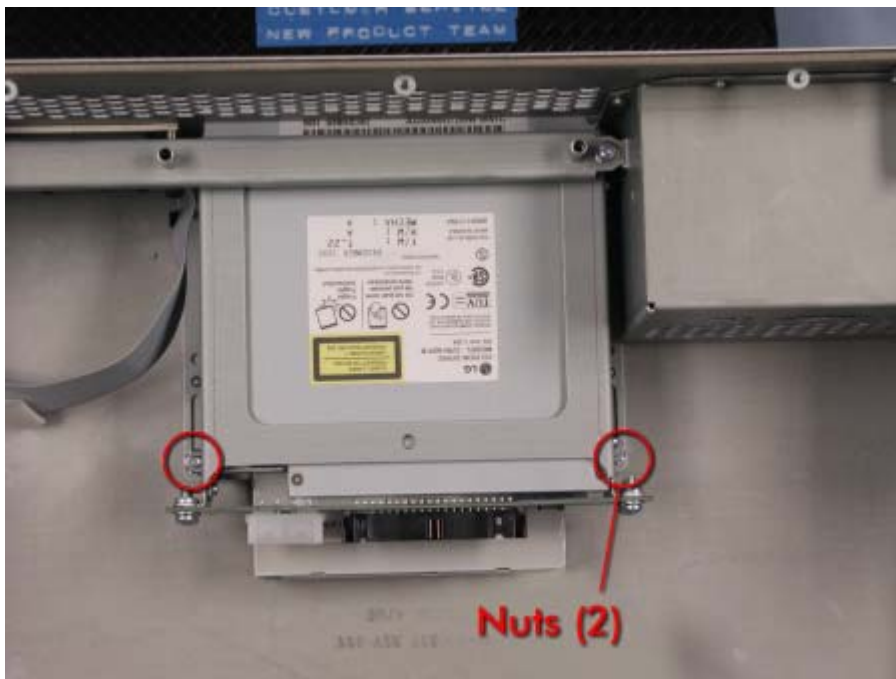
2. Remove the Peripheral Bus Interconnect PCB. (See Section 4.5.10)
3. Disconnect the data and power cables from the IDE Bus PCB and rear of disk drive. (Figure 3B-20)

Figure 3B-20. IDE Bus PCB Cables



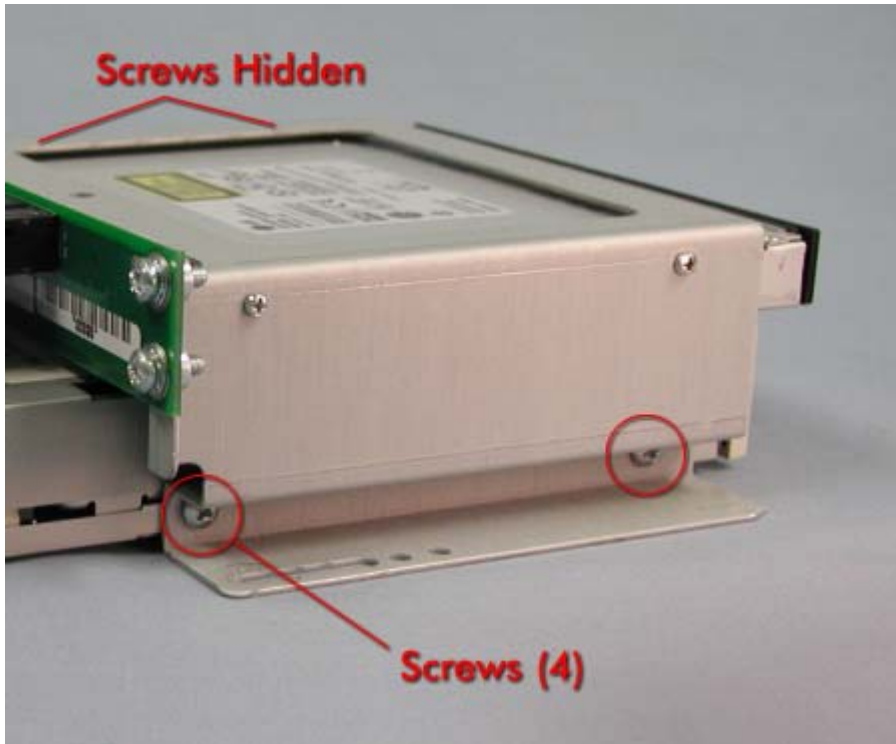
4. Remove the two nuts securing the disk drive cage to the bottom of the Front Panel. Remove the drive cage. (Figure 3B-21)

Figure 3B-21. Disk Drive Cage Nuts



5. Remove the screws securing the High-capacity Disk Drive to the cage. (Figure 3B-22)

Figure 3B-22. Disk Drive Screws

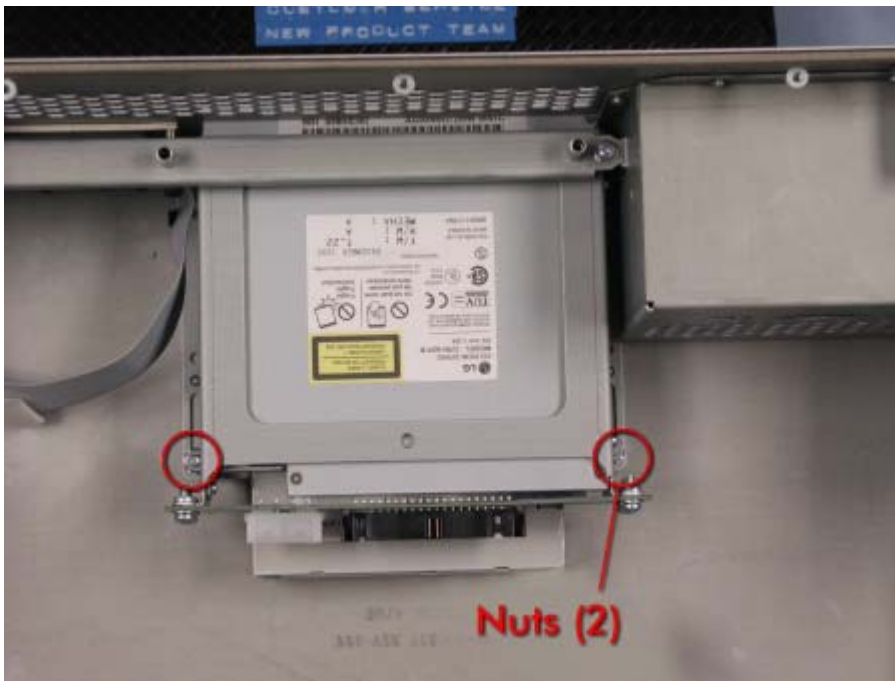


6. Carefully pull the High-capacity Disk Drive out of the cage.

3B.3.6 CD-ROM Drive (AA-D55000)

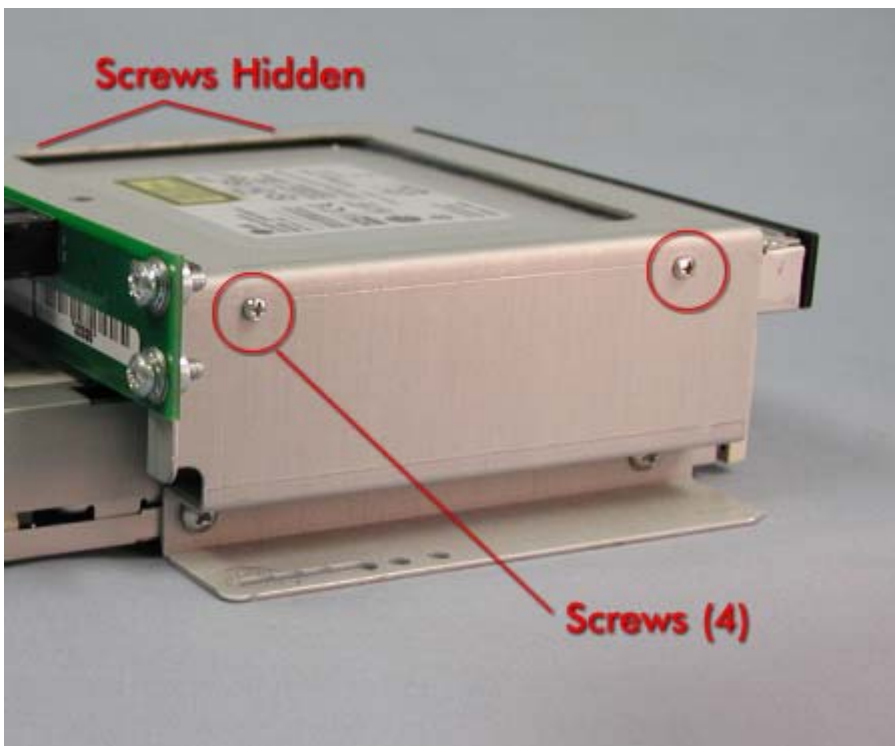
1. Remove the Front Panel (CRU).
2. Remove the Peripheral Bus Interconnect PCB. (See Section 4.5.10 for removal procedure.)
3. Remove the two nuts securing the disk drive cage to the bottom of the Front Panel. Remove the drive cage. (Figure 3B-23)

Figure 3B-23. Disk Drive Cage Nuts



4. Remove the screws securing the CD-ROM drive to the cage. (Figure 3B-24)

Figure 3B-24. CD-ROM Drive cage Screws

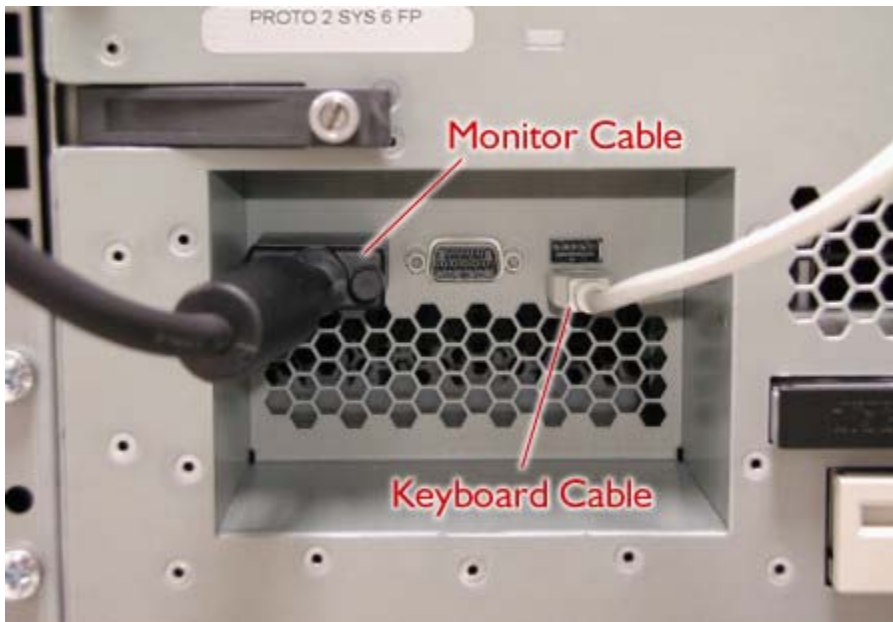


5. Carefully pull the CD-ROM Drive out of the cage.

3B.3.7 PCI Console Shelf

1. At the front of the cabinet, disconnect the monitor and keyboard cables from the front panel. (Figure 3B-25)

Figure 3B-25.



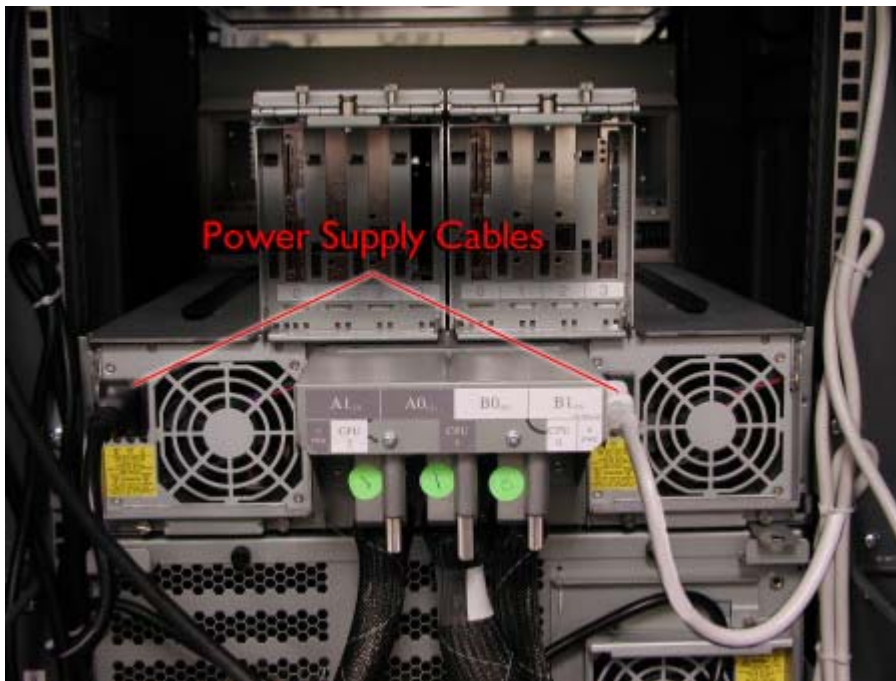
2. Remove the front panel (CRU).
3. Remove the eight screws securing the PCI console shelf at the front of the cabinet. (Figure 3B-26)

Figure 3B-26.



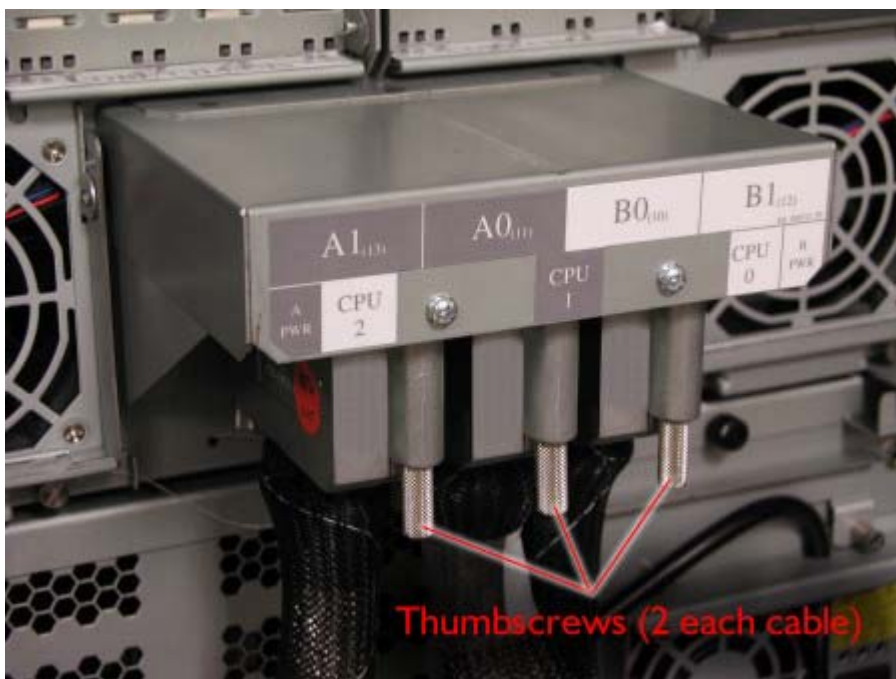
4. At the rear of the cabinet, disconnect all cables from both I/O enclosures.
5. Disconnect the power cords from the PCI power supplies. (Figure 3B-27)

Figure 3B-27.



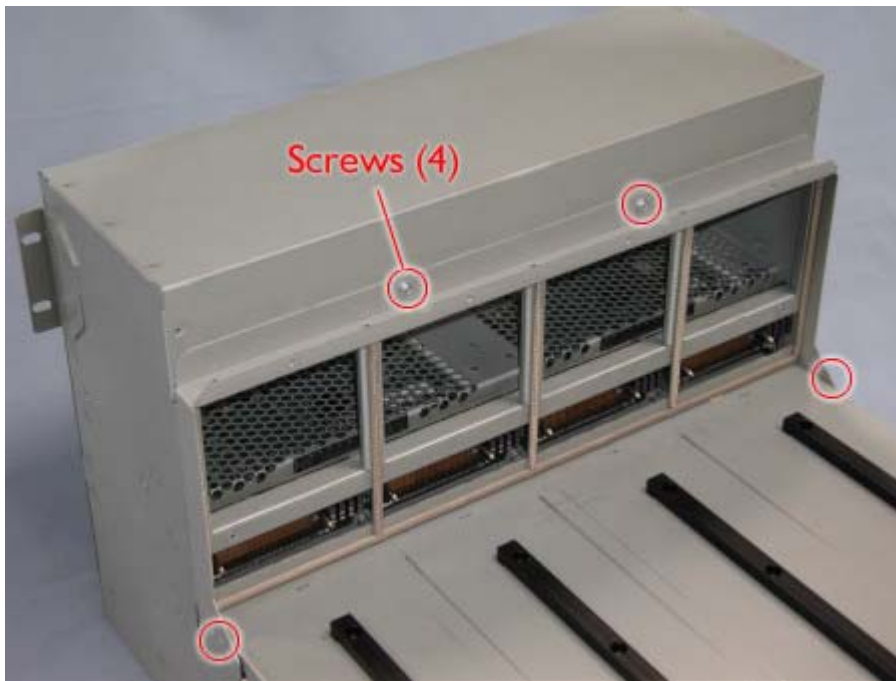
6. Remove both I/O enclosures (CRUs).
7. Loosen the two thumbscrews securing each CPU-to-PCI cable at the rear of the PCI console shelf and remove the cables. (Figure 3B-28)

Figure 3B-28.



8. At the rear of the cabinet, push the PCI console forward a few inches so that it protrudes out the front of the cabinet.
9. At the front of the cabinet, carefully pull the PCI console shelf out of the cabinet and set it on a table.
10. Remove the four screws securing the EMI shield. (Two of the screws are on the side.) (Figure 3B-29)

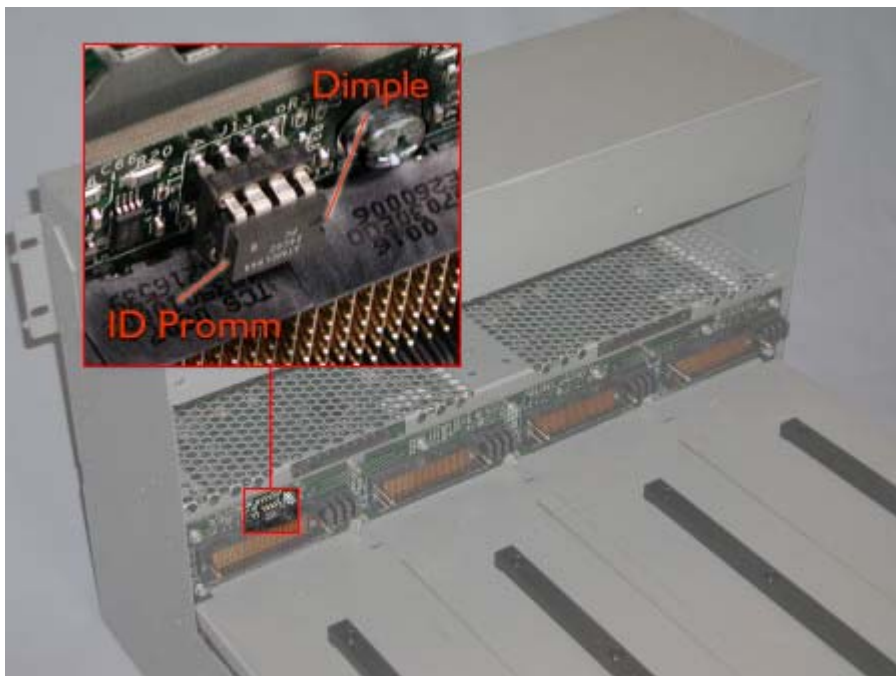
Figure 3B-29.



IMPORTANT: The ID PROM on the faulty PCI Console Shelf has to be removed and inserted on the replacement PCI Console Shelf.

11. To remove the ID PROM from the the faulty PCI Console Shelf, perform the following steps:
 - a. Note the orientation of the ID PROM on the faulty PCI Console Shelf because it will have to be inserted exactly the same way on the replacement PCI Console Shelf. (The dimple in the upper right hand corner is on pin 1.) (Figure 3B-30)

Figure 3B-30.



CAUTION: The pins on the ID PROM bend very easily.

- b. Very carefully pull the ID PROM straight out of its socket, being careful not to bend its pins.
- c. Install the ID PROM on the replacement PCI console shelf, making sure you install it in the same orientation as it was on the faulty PCI console shelf.

3B.3.8 Backup Battery Unit (BBC)

1. Remove the fibre channel enclosure from the cabinet. (CRU)
2. Remove the fan modules from the enclosure. (Figure 4B-31)

Figure 4B-31. Fibre Channel Enclosure Fan Module (R1)



3. Turn the fan module over and disconnect the battery cable. (Figure 4B-32)

Figure 4B-32. Fan Module Battery Cable (R2)



4. Release the tabs securing the battery by pressing inward on the battery as shown in Figure 4B-33.

Figure 4B-33. Releasing the Battery (R2)



4. Theory of Operation

This section contains an overview of the theory of operation for the ftServer 5200 system. It provides information on how the system operates and includes a description of each of the following major assemblies/subsystems.

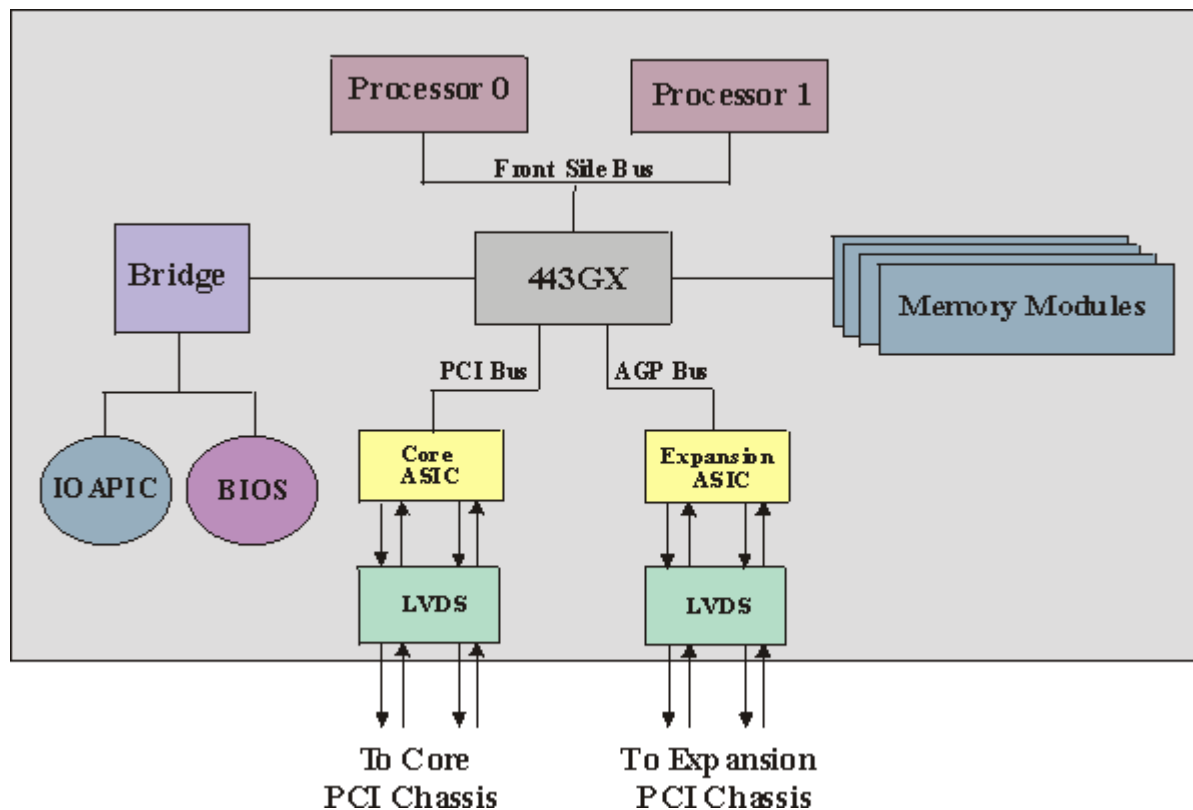
- CPU Enclosure
- PCI Subsystem
- CPU-to-PCI Console Bus
- SCSI Disk Subsystem
- Fibre Channel RAID Subsystem
- Tape Subsystem
- Power Subsystem
- Cooling Subsystem

A high-level architectural view of the ftServer 5200 system is shown in Figure 5-1.

4.1 CPU Enclosure

The following figure is a block diagram of the CPU enclosure.

Figure 5-1. CPU Enclosure Block Diagram



The CPU enclosure supports one or two processors operating at 750 MHz. The processors are Intel® Pentium® III processors. These processor modules support 1- and 2-way Symmetric Multiprocessor Protocol (SMP) with

a memory range of up to 2 GB. The processor modules share a 100-MHz bus, known as the host bus or the Front Side Bus (FSB), with the 443GX Host Bridge/Controller (443GX).

The 443GX is the hub of the CPU Module. It has the following interfaces:

- Processor/system bus support
- Integrated DRAM controller with 100-MHz interface to SDRAM DIMMs (memory modules)
- Peripheral Component Interface (PCI) bus interface (rev 2.1 compliant) 32-bit, 33-MHz)
- Accelerated Graphics Port (AGP) interface (configured as a PCI interface 32-bit, 66-MHz by Stratus)

The PCI interface is known as the compatibility bus since the traditional PC legacy components reside on this bus. This bus interfaces with the Core I/O enclosure boards where the main legacy components reside (IDE, USB, serial ports etc.). In the CPU enclosure, there is a local PCI – ISA bridge. This bridge supports the local 512-KB Flash EPROM BIOS and the I/O Advanced Programmable Interrupt Controller (IOAPIC). The PCI bus is fed directly to the CPU-to-PCI console bus via the core ASIC, which handles the CPU half of the CPU-to-PCI console bus protocol, and a Low Voltage Differential Signaling (LVDS) device. This technology significantly reduces the number of connections required to implement the CPU-to-PCI console interface.

The IOAPIC provides multi-processor interrupt control. It communicates the interrupt status to the processors via a dedicated 3-wire bus (2 data lines and a clock). The device can accept up to 24 programmable interrupts.

The AGP interface is configured as a PCI interface known as the expansion bus and supports concurrent PCI transactions to main memory. This bus is fed directly to the CPU-to-PCI console bus via the expansion ASIC and another LVDS device.

The Stratus I²C Protocol (SIP) interface is available system wide. On the CPU module it controls the power supply and the reset circuitry. In addition to monitoring the power supply status it controls the LEDs, fans, and accessories. The SIP can also interface to the processor and DIMM modules.

The DRAM interface is configured to operate at 100 MHz. The interface supports 72-bit (64-bit memory data plus 8-bit ECC) registered SDRAM DIMMs (memory modules). Each DIMM has an SMB interface that is connected to the SIP bridge. This interface allows software to determine the type of DIMM installed and configure the 443GX accordingly. Up to four 256-MB or 512-MB SDRAM DIMMs are supported in configurations of 256 MB, 512 MB, 1 GB, and 2 GB.

The CPU enclosure has an integrated 450-watt AC power supply with power factor correction and active load sharing capabilities. The power supply has 5 outputs: 3.3V, 5V, 12V, -12V, and 5VSB. The supply is redundant and hot swappable. The power supply has a minimum efficiency of 60% at maximum load and over the specified AC voltage.

The CPU enclosure contains voltage regulator modules (VRMs). There is one VRM for each CPU for core voltage and a shared VRM for L2 cache voltage. The CPUs should **never** be powered up without the VMRs installed.

The following table lists the AC input voltage specifications for the CPU power supply.

Parameter	Minimum	Rated	Maximum
Voltage (110)	90 Vrms	100-120 Vrms	132 Vrms
Voltage (220)	180 Vrms	200-240 Vrms	264 Vrms

Frequency

47 Hz

63 Hz

The CPU enclosure has fault indicators located on the rear and front. They consist of a set of two LEDs: one red and one bicolor (yellow/green).

The CPU enclosure utilizes two core fans designed to support reliable operation between 5 and 35 degrees C. Cooling is from front to back. Fan fault detection. Fault causes CPU enclosure to break and power down.

4.2 PCI Subsystem

The major components in the PCI subsystem are contained in the PCI console shelf, which consists of the following components:

- LVDS I/O power and distribution board
- Front panel
- I/O enclosures (2 core/2 expansion)
- Clock cards (2)
- Power supply units (2)

4.2.1 LVDS I/O Power and Distribution Board

The LVDS I/O Power and Distribution board provides the interconnection between the CPUs and the other components in the console (clock cards, front panel, I/O enclosures). It interfaces with the CPUs via two or three CPU-to-PCI console bus cables.

The LVDS I/O Power and Distribution board contains the system ID PROM.

The LVDS I/O Power and Distribution board is supplied 12 VDC by the 450-watt power supply.

4.2.2 Front Panel

The front panel supports an Ultra2 SCSI-based IDE CD-ROM drive and an optional IDE-based high-capacity floppy drive that supports both floppy and 120-MB floppy cartridges.

The peripheral interconnect bus is a front panel board that performs the bus isolation to the front panel peripheral devices and houses the system ID PROM. It also contains the I2C bus and the front panel LCD. The I2C subsystem includes an A and B bus, which are used to monitor the system and to control certain aspects of the system. For the front panel, the I2C polls the front panel IDPROM and controls the LCD.

The LVDS backplane supplies the 12 VDC power to the front panel.

The buses going into the front panel are duplexed, and the outputs from the front panel are simplex. These buses include the following connectors to attach peripheral devices:

- USB port (2) - for mouse, keyboard, other optional devices
- Serial port - for debug
- VGA port - for monitor
- IDE port - for CD-ROM drive and high-capacity floppy drive

4.2.3 I/O Enclosure

ftServer 5200 systems support two core I/O enclosures and two optional expansion I/O enclosures. The core I/O enclosures are labeled 10 and 11. The expansion I/O enclosures are labeled 12 and 13. The slots within each enclosure are labeled 0, 1, 2, and 3.

The core I/O enclosure is unique in that, in addition to four 32-bit/33-MHz hot-plug PCI slots, it contains a PCI compatibility bridge to ISA to support legacy I/O. It's PCB has IDE and USB interfaces to front panel devices.

The core I/O enclosure houses the ftServer Access adapter, which contains the VGA interface and communicates with a front panel device through the core I/O enclosure.

Each core I/O enclosure can support four 5-volt PCI cards. Slot 3 is reserved for the U460 ftServer Access adapter and the U518 differential SCSI adapter should be located in slot 0. The remaining slots are customer configurable.

The expansion I/O enclosure supports four 5-volt 32-bit/33-MHz PCI cards. All slots (0-3) are customer configurable.

4.2.3.1 PCI Adapters

PCI adapters include the following:

- U460 - ftServer Access adapter
- U515 - 1-port 10/100 Mbps ethernet adapter
- U516 - 1-port differential SCSI adapter (QLA1080)
- U518 - 2-port differential SCSI adapter (QLA1280)

U460 ftServer Access adapter

Each PCI core chassis houses a ftServer Access adapter. The ftServer Access adapter is a Web-based interface that allows an authorized person to remotely control, monitor, and diagnose problems on ftServer 5200 systems. It can call home if the ftServer 5200 server crashes; that is, the ftServer Access adapter automatically contacts the Stratus Support Network (SSN) if the server crashes. The card enables an authorized person to access the ftServer 5200 console and keyboard remotely through the SSN or a local network, providing access that is independent of the states of the host power and operating systems. The ftServer Access adapter also implements the Stratus System Controller (SSC), which is a central part of the Maintenance and Diagnostics subsystem of a ftServer 5200 system.

The ftServer Access adapter can operate independently of the host system because it contains its own processor and memory, and it has access to a backup power supply for housekeeping power (receives constant 5VDC input). The ftServer Access adapter contains its own Motorola® PowerQUICC® processor, an integrated PowerPC® microprocessor and peripheral controller. It also contains 16 MB of parity-protected Synchronous Dynamic Random Access Memory (SDRAM). The ftServer Access adapter includes subsystems for video, monitoring, and power.

The ftServer Access adapter supports dual independent I²C bus connections, UART and debug ports, network/telecommunication interfaces including a local 10/100 connector with pass-thru functionality. It also implements the system's VGA subsystem as well as providing a real time clock, NVRAM for logging OS state, and local voltage/temperature sensing capabilities. The I²C bus is a 2-bit standard serial interface to all the

boards which allows the ftServer Access adapter to obtain their status. It also allows the adapter to power on and off components in the system.

Each ftServer 5200 system requires two ftServer Access adapters for fault tolerance. One ftServer Access adapter must reside in slot 3 in one core I/O enclosure; the second ftServer Access adapter must reside in slot 3 of the second core I/O enclosure. If one ftServer Access adapter fails or is removed, or if the core I/O enclosure that contains the ftServer Access adapter is removed, the second ftServer Access adapter detects the problem and takes over monitoring the server. The ftServer Access adapter cannot reside in an expansion I/O enclosure.

The ftServer Access adapter contains a reset button, which is intended primarily for debugging.

WARNING: The U460 ftServer Access adapter contains a battery. Do not remove the battery. Danger of explosion exists if the battery is incorrectly replaced. Replace only with the same or equivalent type of battery recommended by the manufacturer. Dispose of used batteries according to the manufacturer's instructions.

U514 Fibre Channel Adapter

The U514 is a Qlogic 2200/33 64bit/33MHz fibre channel card with one external HSSDC copper connector (or a Qlogic 2300 fibre channel card 64bit/66MHz). This card can support one Eurologic Channel storage enclosure.

The U514 is a standard PCI card that conforms to PCI Local Bus Specification 2.2, Sbus-IEEE 1496-1993. Power consumption for the card is <2 Watts.

U515 1-port 10/100 Mbps Ethernet Adapter

The U515 Ethernet PCI adapter is a single-port, Intel ® Network Interface Card (NIC), based on the Intel 82559 Local Area Network (LAN) controller. The U515 supports 10BASE-T and 100BASE-TX Ethernet network topologies for data rates of 10 and 100 megabits-per-second (Mbps) with a data-path width of 32 bits. It uses auto-negotiation and/or automatic sensing to automatically select half- and full-duplex line speeds of 100BASE-TX or 10BASE-T. The U515 contains 6 kilobytes of on-board memory. It uses standard RJ-45 Category-5 unshielded twisted pair (UTP) cable connections.

The U515 ethernet adapter can reside in a core I/O enclosure or an expansion I/O enclosure.

U516 QLA1080 SCSI Controller

The U516 QLA1080 SCSI controller is a single-port Ultra 2 SCSI adapter (HBA) board manufactured by Qlogics.. The QLA1080 is configured as a single-initiator supporting tape drive operation. This means that a single controller is connected to a SCSI bus. Each QLA1080 can support two tape drives.

The QLA1080 has a 64-bit Direct Memory Access (DMA) bus master. Its Instruction Set Processor (ISP) chip provides intelligence and high performance by combining a Reduced Instruction Set Computing (RISC) processor, a SCSI executive processor (SXP), and a peripheral component interconnect (PCI) local bus.

The QLA1080 supports transfer rates up to 80 MB/sec of Ultra2 Low Voltage Differential (LVD) Signalling. It is compatible with SCSI-2, SCSI-3, Ultra SCSI, and Ultra2 SCSI peripherals. The card supports both 32-bit and 64-bit PCI buses at 33 megahertz (MHz).

The U516 can reside in a core I/O enclosure or an expansion I/O enclosure. If two are used, they should reside in different chassis.

The SCSI ID of the U516 is 7.

U518 QLA1280 SCSI Controller

The QLA1280 SCSI controller is a host bus adapter (HBA) board manufactured by Qlogics. It is a single slot PCI bus expansion board that interfaces a 32-bit PCI bus to two Low Voltage Differential (LVD) Ultra2 SCSI busses. The board supports both 32-bit and 64-bit PCI transfers as a bus master during DMA transfers and 16-bit transfers as a slave during PIO operations. It supports the disk drives in the storage enclosures.

The QLA1280 controller is configured as a dual-initiator. This means that two different controllers (primary and secondary) are connected to the same SCSI bus. One controller is the 'primary' for bus 0 and the 'secondary' for bus 1. The other controller is the 'primary' for bus 1 and the 'secondary' for bus 0. The same controller does not take on the role of 'primary' for both busses. Two external connectors (68-pin VHDCI) and one internal connector (68-pin SCSI-II) are used to connect to the SCSI busses. Jumpers and a BIOS utility are provided to control the various SCSI bus options.

The QLA1280 incorporates the Qlogic ISP1280 SCSI Controller chip. This chip contains all of the control logic required to interface the PCI bus to two SCSI Ultra2 busses including the LVD transceivers.

The QLA1280 conforms to the PCI Local Bus Specification Rev 2.1. It draws power from the PCI 5-volt pins and regulates it to 3.3 volts. The board supplies the PCI V/I/O to the ISP1280's VDDPCI pins, assuring that the PCI bus will be driven at the correct level. The typical operating current of the QLA1280 is 0.941 A @ 5V with a maximum of 3 A. Typical power consumption is less than 5 watts. Maximum dissipation is 15 watts..

The QLA1280 is designed to accommodate either one or two RISC SRAM's. They can either be 32Kx16 or 64Kx16 parts (32K or 64K bytes). The standard configuration will have a single 64Kx16 SRAM.

The board contains a 128K byte Flash ROM. The ISP1280 controller chip controls the Flash ROM directly. This flash ROM is arranged into two 64K byte banks. It also supports a 2K bit NVRAM that is controlled by the ISP1280 directly and can be accessed by the software drivers. The NVRAM contains configuration information. Some of this information is fixed based on the board's type. Other portions can be altered by the user to tune or optimize the board's operation for their particular environment.

The QLA1280 board supplies termination power to itself and to the SCSI bus. The circuit is protected by a self-restoring fuse. There is no means of turning termination power off, therefore the card permanently supplies termpower to the SCSI bus.

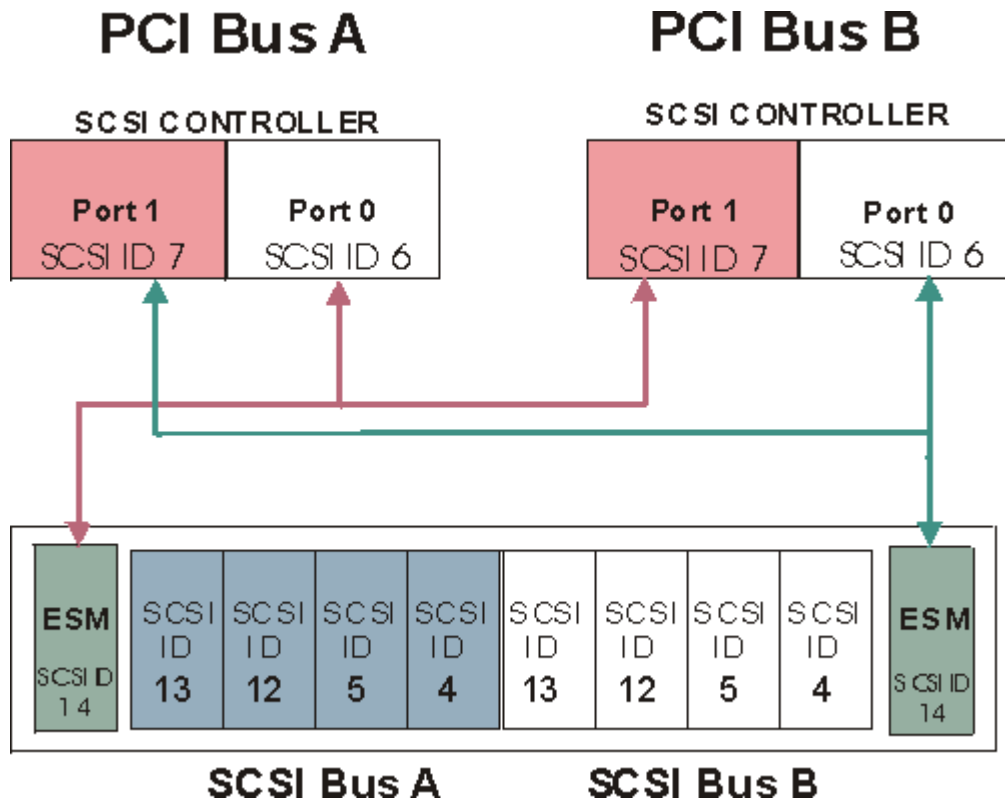
Power to the board is derived from the dedicated PCI 5.0V power pins. The PCI I/O power pins (V/I/O) are used as a reference voltage for the PCI pad ring. The 5.0V is regulated down to 3.3V for power to the ISP1280 core and support logic.

The SCSI ID for the QLA1280 is 6 or 7, depending on the configuration of the SCSI busses.

One U518 must reside in slot 0 in one core I/O enclosure; a second U518 must reside in slot 0 of the second I/O enclosure.

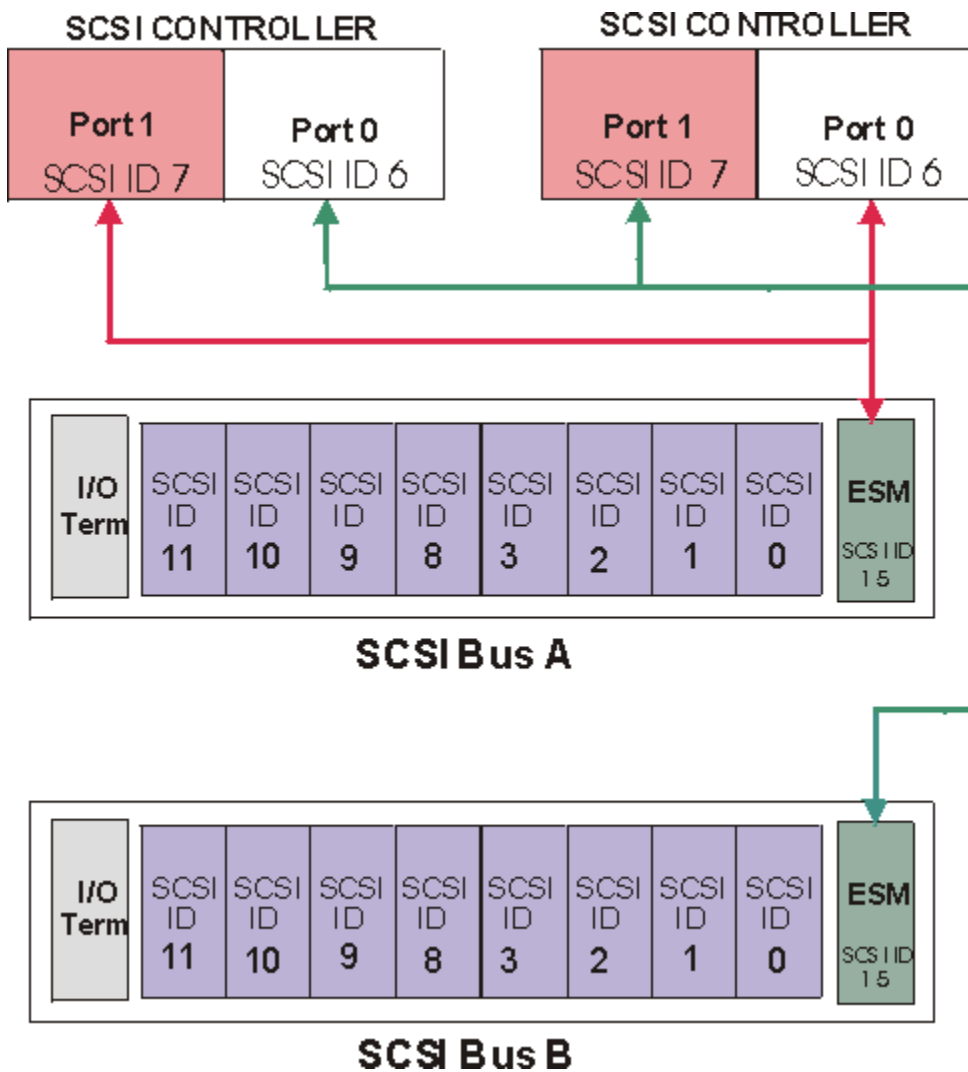
The following figure shows how the SCSI controllers are connected in a split backplane configuration.

Figure 5-x. Split Backplane Configuration



The following figure shows how the SCSI controllers are connected in a joined backplane configuration.

Figure 5-x. Joined Backplane Configuration



4.2.4 Clock Card

There are two clock cards in the system. One is the master, the other is a slave. Each has clock drivers that drive clocks to half the system. A failure of a clock buffer on either card will shut down $\frac{1}{2}$ the system. A failure of the master oscillator will crash the whole system. Each card is capable of being used as a master, so there is a redundant oscillator shipped with every system. The A position is the slave. It supports CPU enclosure 1, core I/O enclosure 11, and expansion I/O enclosure 13. The B position is the master. It supports CPU enclosures 0 and 2, core I/O enclosure 10, and expansion I/O enclosure 12. The cards are auto configured by position.

The clock cards have 5V standby power for the LED. The LVDS backplane supplies the 12V power to the clock cards.

4.2.5 Power Supply Unit

Power is supplied to the PCI console through two two 450-watt power supply units, which are labeled A and B. Each power supply receives AC input and outputs 5 VDC, 3.3 VDC, 12 VDC, and -12 VDC power for a core and expansion I/O enclosure.

4.3 CPU-to-PCI Console Bus

The CPU-to-PCI console cables connect the CPU enclosures to the PCI console shelf via the CPU-to-PCI console bus, which utilizes LVDS technology to transmit and receive data. Each CPU enclosure has one connection to each of the I/O enclosures. The CPU-to-PCI console cables are labeled 0, 1, and 2.

Each core ASIC in the CPU enclosure interfaces to two ASICs in the PCI console over half of the CPU-to-PCI console bus, which consists of point-to-point LVDS links, forming two separate PCI-to-PCI bridges. The point-to-point links are uni-directional, 32 bits wide, and operate at 66 MHz.

These PCI bridges connect to their counterparts across the CPU-to-PCI console bus, one to the Core 0 I/O enclosure and the other to the Core 1 I/O enclosure. The core ASIC 0 link feeds a LVDS receiver/transmitter pair as does the core ASIC 1. The core ASIC passes the I/O interrupts and the Intel sideband signals from the core I/O enclosure through the CPU-to-PCI console bus. The Intel sideband signals are a set of signals that are used in legacy Intel architecture. These signals originate in the I/O subsystem and need to be passed to the processor for compatibility purposes.

The CPU-to-PCI console bus is source synchronous. This means that the clock used to transmit the data is also sent with the data. The data is then clocked into the receiving device using the transmitted clock. The data must then be re-synchronized to the local receive clock.

Each expansion ASIC in the CPU enclosure interfaces to two ASICs in the PCI console over the other half of the CPU-to-PCI console bus. This 443GX AGP/PCI bus supports 32-bit, 66MHz transactions and is Rev 2.1 compliant. The expansion ASIC-to-PCI console ASIC PCI bridge reconfigures the 32-bit, 66-MHz PCI into a 64-bit, 33-MHz PCI in the expansion I/O enclosure to support the four 64-bit, 33-MHz expansion slots. The 66-MHz PCI clock for this bus is generated by the 443GX.

4.4 SCSI Disk Subsystem

4.4.1 SCSI Storage Enclosure

The major component in the disk subsystem is the storage enclosure, which is installed in a 19-inch rack mount configuration. It consists of the following components:

- disk drives
- Repeater-Enclosure services modules (R-ESMs) (1 or 2)
- I/O terminator modules (1 or 2)
- Power supplies (1 or 2)
- Fan units (2 or 3)

Devices in the storage enclosure are controlled by U518 QLA1280 SCSI controllers.

4.4.1.1 Disk Drives

Each storage enclosure supports up to eight hot-pluggable, 3.5", Ultra-2 LVD, 10K RPM disk drives of various capacities (9GB, 18GB, 36GB). The disk drives are connected directly to the enclosure backplane via 80-pin SCA-2 connectors. A maximum of 16 disk drives is supported.

The storage enclosure firmware supports automatic spin-up of disk drives. Any drives located in the four slots with the highest SCSI ID's (slots 5-8) will spin up when the enclosure is powered on and any remaining drives will spin up staggered based on their SCSI ID times 12 seconds (the time interval is selectable).

Each disk drive contains three status LEDs that are visible from the front of the storage enclosure. The green LED on the left indicates disk drive present, the green LED in the middle indicates disk activity, and the amber LED indicates disk fault.

4.4.1.2 Repeater-Enclosure Services Module (R-ESM)

The R-ESM provides monitoring and control of the storage enclosure (disk drives, power supplies, fans). It reports status and receives control information via the SCSI bus.

The following are the three primary functions of the R-ESM:

- Serves as a SCSI bus pass-through from external cabling to the internal backplane
- Provides SCSI multi-mode termination to the SCSI bus in the absence of an external cable
- Provides monitoring and control of the storage enclosure

The R-ESM does not have a status LED.

R-ESM features include the following:

- Microcontroller for data processing, control, and communications
- Volatile and non-volatile memory for the microcontroller
- FPGA for system logic including data input/output and LED indicator control
- Temperature sensor
- SCSI LVD multimode protocol and interface chip
- SCSI LVD multimode termination
- Firmware downloadable online via SCSI write buffer command or SES page

4.4.1.3 I/O Terminator Module

The I/O terminator module provides automatic termination of the SCSI bus. It does not monitor and report enclosure status.

4.4.1.4 Power Supply

The storage enclosure requires one power supply for normal operation. A second power supply is optional to provide redundancy for the power system.

4.4.1.5 Fan Unit

The storage enclosure requires two fans for normal operation. A third fan is optional which provides redundancy for the cooling system. A fan blank is required to provide the proper airflow when only two fans are being used. The storage enclosure can run with two fans operational and a single fan failed. The storage enclosure provides front to back airflow cooling. The fans are hot-pluggable and redundant. Each fan RPM is monitored and each fan unit has an amber fault indicator located on the fan assembly.

The fans have a multiple speed capability and the R-ESM sets the fan speed depending upon ambient temperature and failure status. The fans are set to high speed if one or more fans are detected to have failed. The fans are also set to high speed if one or more power supplies are detected to have failed. The redundant configuration includes three fans. The non-redundant configuration includes two fans and a fan blank. The R-ESM firmware determines the SCSI configuration and the fan speed is set depending upon ambient temperature.

Each of the fans has an amber error LED which is visible from the rear of the storage enclosure. The fan error LED is OFF when the fan is operating normally. The fan error LED is ON when the R-ESM has detected a fan speed fault.

4.4.1.6 Cabling

The external cable length supported is up to 12 meters for a single Ultra-2 LVD SCSI enclosure with 8 disk drives. Daisy chaining storage enclosures is supported in Ultra-2 LVD SCSI mode with an external cable length of up to 8 meters to the first Ultra-2 LVD SCSI enclosure with 8 disk drives, and then daisy chained through a 1.0 meter cable to a second Ultra-2 LVD SCSI enclosure with 4 disk drives.

4.4.2 SCSI Bus

The SCSI bus is a multi-mode Low Voltage Differential (LVD) interface that supports Ultra-2 LVD (80 MB/sec) 10K RPM disk drives of various capacities (9GB, 18GB, 36GB). The storage enclosure interconnect is a multi-mode SCSI interface.

The SCSI backplane contains no active components and supports hot plugging of disk drives, power supplies, and fans. The backplane supports the full 80 MB/sec bandwidth specified by Ultra-2 LVD SCSI for each configured bus.

The host bus adapter (HBA) board for the SCSI I/O system is a single slot PCI bus expansion board that interfaces the 32-bit PCI bus to two LVD Ultra2 SCSI buses. The HBA is used in a dual-initiated environment.

Each SCSI bus is capable of selecting 16 SCSI IDs (0-15) and at least 16 logical unit numbers (LUNs) per SCSI ID.

4.4.3 SCSI Bus Configurations

The SCSI backplane supports two system configurations:

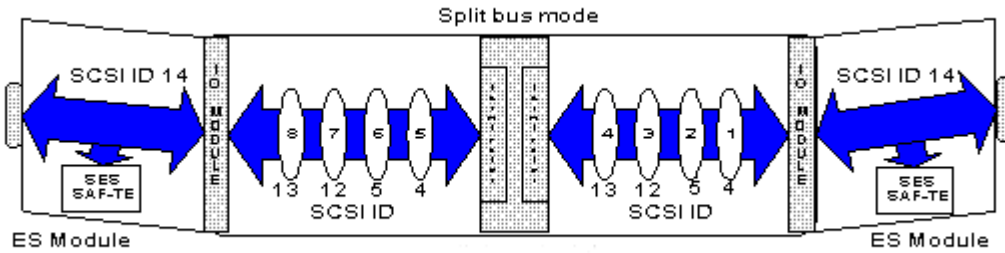
- Split bus
- Joined bus

4.4.3.1 Split Bus

Split bus supports four disk drives per SCSI bus in a single storage enclosure. There are two R-ESMs located in the rear of the enclosure, one on each end. Each R-ESM reports enclosure information over the SCSI bus that it is connected to.

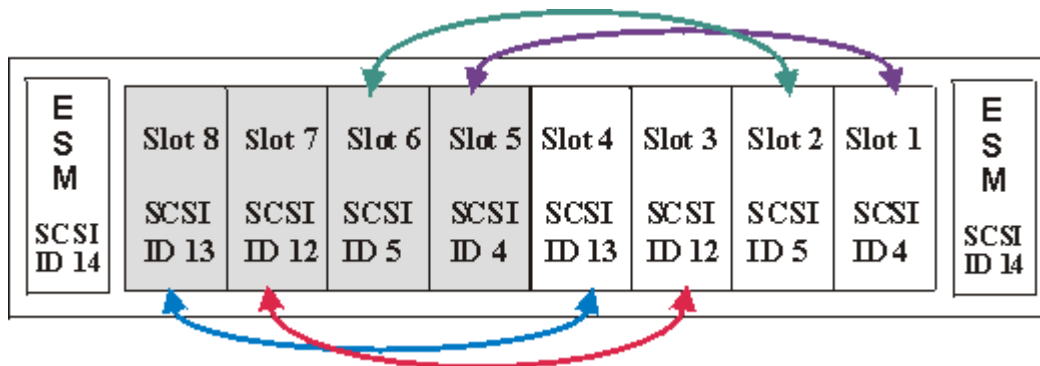
The following figure shows the storage enclosure slot assignments and SCSI IDs for split bus mode. The numbers (1-8) in the ovals represent the enclosure slot position. The SCSI ID number listed beneath each one is the ID assigned to that slot position in the split bus configuration.

Figure 5-x. Split Bus Mode



The following figure illustrates how the disks are mirrored in a disk enclosure that is configured in split bus mode. The arrows connect the disks that are duplexed.

Figure 5-x. Duplexing of Disks in Split Bus Mode

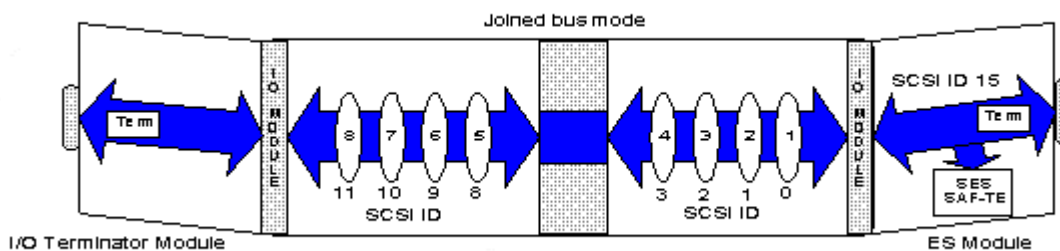


4.4.3.2 Joined Bus

Joined bus supports eight disk drives per SCSI bus in two storage enclosures. The SCSI enclosure contains one I/O terminator and one R-ESM. The R-ESM reports the enclosure information via the SCSI bus and performs control functions for the storage enclosure

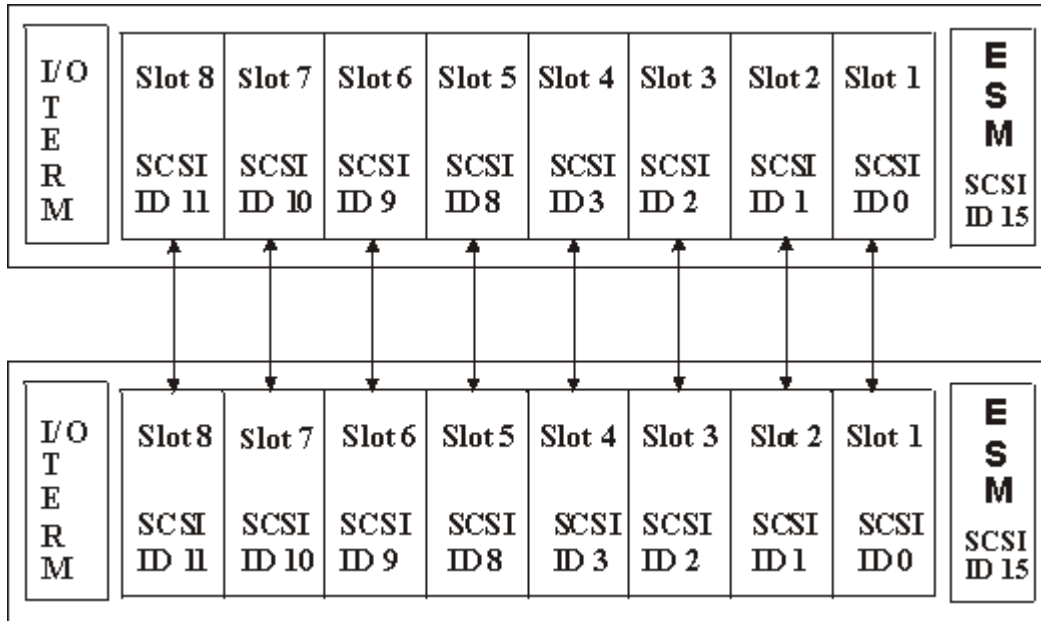
The following figure shows each storage enclosure slot assignments and SCSI IDs for joined bus mode. The numbers (1-8) in the ovals represent the enclosure slot position. The SCSI ID number listed beneath each one is the ID assigned to that slot position in the joined bus configuration.

Figure 5-x. Joined Bus Mode



The following figure illustrates how the disks are mirrored between two disk enclosures that are each configured in joined bus mode. The arrows connect the disks that are duplexed.

Figure 5-x. Duplexing of Disks in Joined Bus Mode



4.4.4 SCSI Bus Termination

The storage enclosure provides automatic termination of the SCSI bus in both split bus and joined bus via the multi-mode SCSI I/O terminator module. The automatic bus termination requires that pin 49 of the 68-pin SCSI connector is grounded externally (i.e. by an HBA or daisy chained device) to turn off the internal termination.

SCSI termpower is routed in from one I/O terminator or R-ESM through the backplane and back out the other I/O terminator or R-ESM.

4.4.5 SCSI ID Slot Assignment

As shown in the figures above, each slot on the storage enclosure has a unique SCSI ID assigned to it. The R-ESM has a SCSI ID assignment of 14 for split bus and 15 for joined bus. ID's 6 and 7 are reserved for use by initiators (HBAs).

SCSI ID mapping

Split bus	Bus 1 IDs	Bus 2 IDs
Slot 1	4	
Slot 2	5	
Slot 3	12	
Slot 4	13	
Slot 5		4
Slot 6		5

Slot 7		12
Slot 8		13
R-ESM	14	14

Joined bus	ID
Slot 1	0
Slot 2	1
Slot 3	2
Slot 4	3
Slot 5	8
Slot 6	9
Slot 7	10
Slot 8	11
R-ESM	15

4.4.6 Switch Settings for SCSI Bus Configurations

The LVD SCSI bus is automatically configured as a split or joined SCSI bus (4 or 8 drives per bus) with proper internal termination.

The following figures show supported configurations and the correct switch settings on the ES module and I/O terminator module for each configuration. Switch settings should only be changed when the enclosure is powered off, and will take effect when the enclosure is powered on.

Note: The figures show the rear view of the enclosure. The slot numbers denote the approximate disk drive slot positions.

Figure 5-x. Split SCSI Bus 1x4 and 1x4, Two HBA's

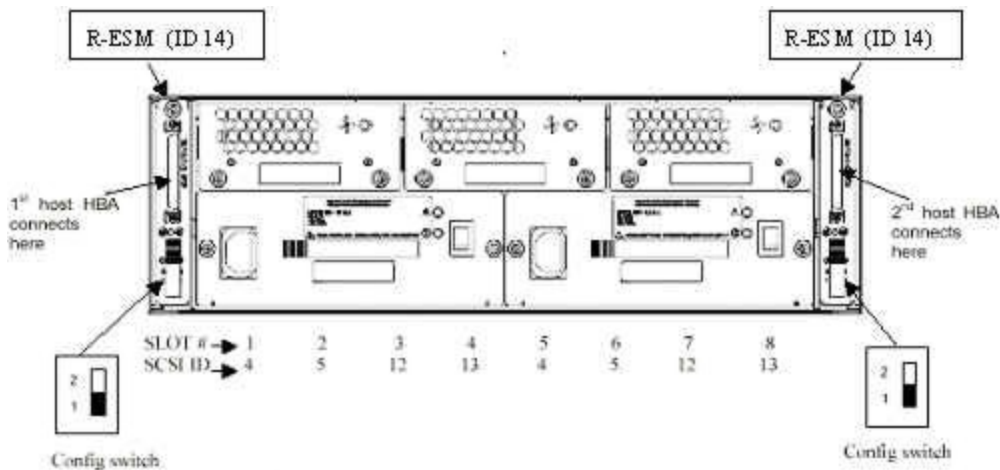
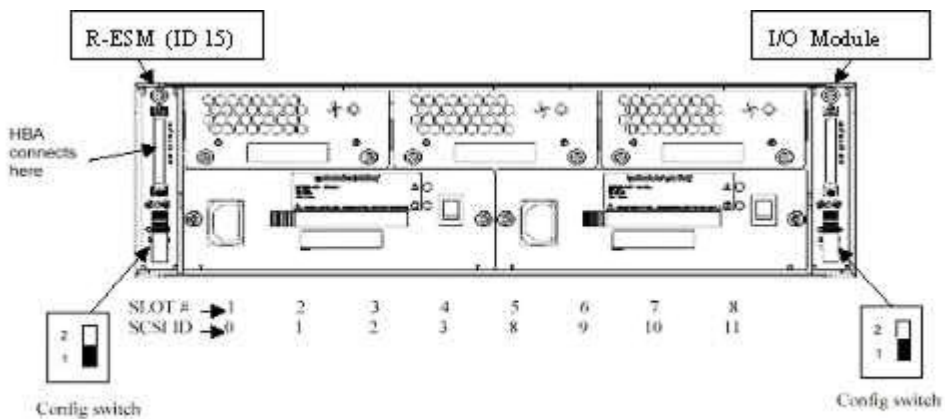


Figure 5-x. Joined SCSI Bus 1x8, One HBA



4.5 Fibre Channel RAID Storage Subsystem

The following are the main features of the Fibre Channel disk storage subsystem.

- One or two Fibre Channel RAID Controllers
- Redundant, hot swappable AC power supply modules.
- Redundant, hot swappable Cooling System.
- Two redundant LS Modules (Loop Resiliency and SES Module)
- Enclosure Services via in-band SES
- Enclosure events notified through LEDs and audible alarm (with software or manual disable)
- ID switch module to set enclosure ID
- Support for 14 Fibre Channel 1" disk drives
- Dual fibre channel loop support with two LS modules
- 2-GB ready midplane
- Disk drive hot plug supported
- Optional Fibre Channel optical interface support on I/O module

4.5.1 Fibre Channel Storage Enclosure

The major component in the Fibre Channel storage subsystem is the storage enclosure, which is installed in a 19-inch rack mount configuration. It can accommodate up to 14 1-inch disk drives.

The following subsections describe the components in the Fibre Channel storage enclosure.

4.5.1.1 RAID Controller

The RAID Controller is a Eurologic FC2500 Series high performance Fibre Channel disk RAID controller, providing one fibre host channel and two fibre disk channels conforming to the Fibre Channel Arbitrated Loop (FC-AL) standards. The logical protocol used for both host and disk communications is 100MB/s Fibre Channel Protocol (FCP) SCSI over fibre.

The RAID controller implements scalable data cache memory on the controller and utilizes 128 MB of ECC protected SDRAM. A single DIMM location accepts Eurologic qualified, 168-pin, 72-data bit, 100MHz, 3.3V, SDRAM DIMMs. Cache memory is also protected by the Battery Backup Unit (BBU).

The RAID controller provides FC_AL host performance and fault tolerant RAID disk operations for Fibre Channel (FC) disk environments. The controller is an intelligent, caching controller that supports RAID levels 0, 1, 3, 5, 0+1, JBOD, 30 and 50. The controller allows multiple hosts to access the array of disk drives, which can be configured as one or more virtual devices (logical units).

The RAID controller permits continuous access to the data in the event of a disk drive failure. The controller also provides continuous access to data in the event of a controller failure. This capability comes with a dual active controller system, using two RAID controllers that share access to the same array of disk drives. In the event of a controller failure, the surviving controller through a *fail-over* process assumes controller operations. The failed controller can then be removed and replaced while the system is still online. The new controller resumes processing array operations in a *failback* process. During fail-over and fail-back, write cache coherency is maintained with the disk drives.

The RAID controller is capable of monitoring a customer provided UPS. The controller fault management features are based on the SCSI-3 Enclosure Services (SES) device interface.

An SES firmware process handles all enclosure fault management. The process polls the environment every ten seconds. Failures with disk drives are handled by the RAID controller firmware with other failures such as fans, power supplies, and temperature sensors being handled directly by the SES device. The controller firmware communicates with the SES device via Send Diagnostics and Receive Diagnostics SCSI commands. The device elements supported by the SES process include: device (disk drive), power supply, cooling, temperature, Enclosure Services, controller electronics, audible alarm, and uninterruptible power supply.

The RAID controller uses the 233MHz Intel SA 110 StrongARM processor and implements separate control store and data cache memory. The control store memory is dedicated to the processor and is located on the processor local bus. The control store memory includes a 32MB 100 Mhz 36-bit parity-protected SDRAM

One 2-MB flash PROM is provided on the controller board for non-volatile storage of the operating program. The SA100 boots from this flash PROM space. The flash PROM device is preprogrammed in manufacturing, but can be updated via firmware download utilities.

4.5.1.2 Advanced Cooling Module (ACM)

Cooling is provided by the two Advanced Cooling Modules (ACMs) located at the rear of the enclosure. Each

of the ACMs contain two variable speed fans. The enclosure requires four fans for normal operation, but will operate correctly with one fan failed (redundancy is lost if one fan is failed in either ACM); therefore, it is recommended that the failed fan be replaced as soon as possible.

The storage enclosure provides front to back airflow cooling. The ACMs are hot swappable. Each fan RPM is monitored and each ACM has two amber fault indicators located on the ACM assembly. Within an ACM, each fan receives its own power, control, and I/O independent of the other fan. Fan cabling and logic are fan specific and allow the system as a whole to function as four independent fans.

The ACMs can be hot swapped. The LSM monitors and controls the speed of each fan. The speed is set depending on the ambient temperature and failed status. The fans are set to full speed if one fan is failed. The following table shows how the fan speed relates to temperature change.

ACM Speed	Ambient Temp (C)
Speed 1	0 to 26
Speed 2	26 to 28
Speed 3	28 to 30
Full Speed	30 +

Note: All fans are set to the same speed.

The ACM accommodates an optional battery back-up unit (BBU) for maintaining memory content in case of an AC power failure. The principle purpose of the BBU is to provide ride-through during a power glitch.

The BBU is designed to work with SDRAM memory, and supports both the processor control store and ASIC cache memory SDRAM. The BBU logic detects power loss on the controller and switches the SDRAM to a self-refresh mode while transparently switching the power input from +5V to battery. The BBU can sustain memory content for at least 72 hours under typical operating conditions.

4.5.1.3 Loop Resiliency and SES Module (LSM)

The Loop Resiliency and SES Module (LSM) is the main monitoring and control device of the Fibre Channel storage subsystem. The module reports status and receives control information over the Enclosure Services Interface (ESI) port of any of the fourteen disk drives installed in the enclosure. The LSM also provides loop resiliency for the Fibre Channel loop (in the form of Port Bypass Circuits).

The Fibre Channel storage subsystem contains one LSM as standard. However, a second optional LSM is available to provide active/passive fail over for the enclosure services communication, and to provide a second Fibre Channel Loop. Only one LSM communicates (using ESI communication) with the host system at any one time, but both LSMs continuously monitor the system. If the active LSM fails, then the ESI communication with the host system will be taken over by the passive LSM.

The following are features of the LSM:

- Monitoring/Control for 2 power supplies and 2 ACMs
- Reports status and receives control information via the FC loop
- Microcontroller for data processing, control and communications
- Volatile and non-volatile memory for the microcontroller
- Temperature sensor

- Audible alarm with manual and software disable
- FC link monitoring and status information
- Firmware download capability
- Reporting of PSU, LSM, I/O module, and backplane serial number and revision
- I/O module and backplane type reporting
- Control of 6 front LEDs for enclosure and module status
- I/O option slot status monitoring

4.5.1.4 I/O Module

The I/O module is used to provide device expansion from the RAID controller. It has two HSSDC connectors. The first is the primary FC loop input port and the second is available for Fibre Channel loop expansion/input. A loop back terminator is not required since the I/O module will automatically enable the expansion HSSDC connector when valid Fibre Channel signals are present on the expansion connector.

4.5.1.5 Power Supply Module (PSM)

The Fibre Channel storage subsystem has two power supply modules (PSMs) for normal operation, providing redundancy of the power system. The PSMs provide 673 Watts continuous output power and 853 Watts peak output power. They have a universal input voltage range, and active current sharing. Power factor correction, over current and over voltage protection is also provided, along with AC voltage brown-out detection.

4.5.2 Enclosure/Disk IDs

Each of the fourteen disk drive slots in the enclosure has a unique identifier assigned to it. This identifier is assigned using a combination of the slot number and the enclosure ID.

The enclosure ID is set using the enclosure ID switch, which is located on the rear of the enclosure. For Stratus systems the enclosure ID switch can be set to 0, 1 or 2. The D570 (first enclosure) has ID 0, the first D580 (second enclosure) has ID 1, and the second D580 (third enclosure) has ID 2.

Each enclosure must have a separate ID when daisy chained together.

NOTE: The enclosure ID must be set prior to powering on the enclosure.

The following figure shows the slot numbers and locations of the disk drives when viewed from the front of the enclosure.

LSM
Slot 0
Slot 1
Slot 2
Slot 3
Slot 4
Slot 5
Slot 6
Slot 7
Slot 8
Slot 9
Slot 10
Slot 11
Slot 12
Slot 13
LSM

The fourteen disk drive slots (0 to 13) are assigned an identifier based on the enclosure ID and the slot number as shown in the following table.

Enclosure ID Drive Slot	0	1	2
Slot 0	3	18	33
Slot 1	4	19	34
Slot 2	5	20	35
Slot 3	6	21	36
Slot 4	7	22	37
Slot 5	8	23	38
Slot 6	9	24	39
Slot 7	10	25	40
Slot 8	11	26	41
Slot 9	12	27	42
Slot 10	13	28	43
Slot 11	14	29	44
Slot 12	15	30	45
Slot 13	16	31	46

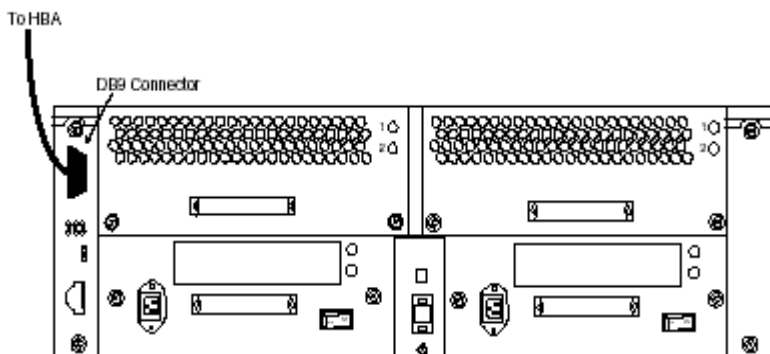
4.5.3 RAID Configurations

There are two main RAID configurations: single RAID Controller and dual RAID Controller (fully redundant).

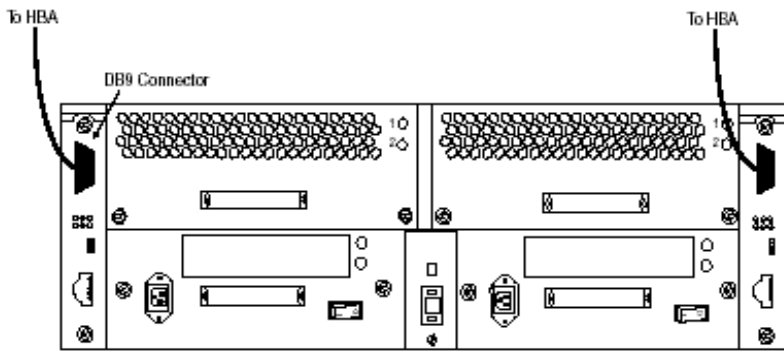
The following subsections describe the possible configurations for single and dual RAID controllers.

NOTE: HBA (host bus adapter) is the U514 adapter.

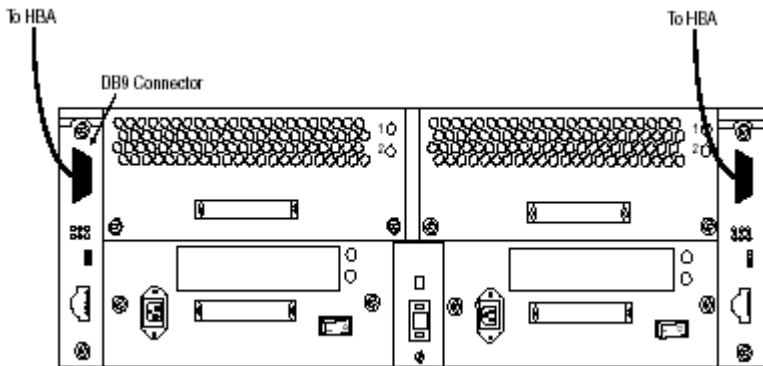
4.5.3.1 Single RAID Controller



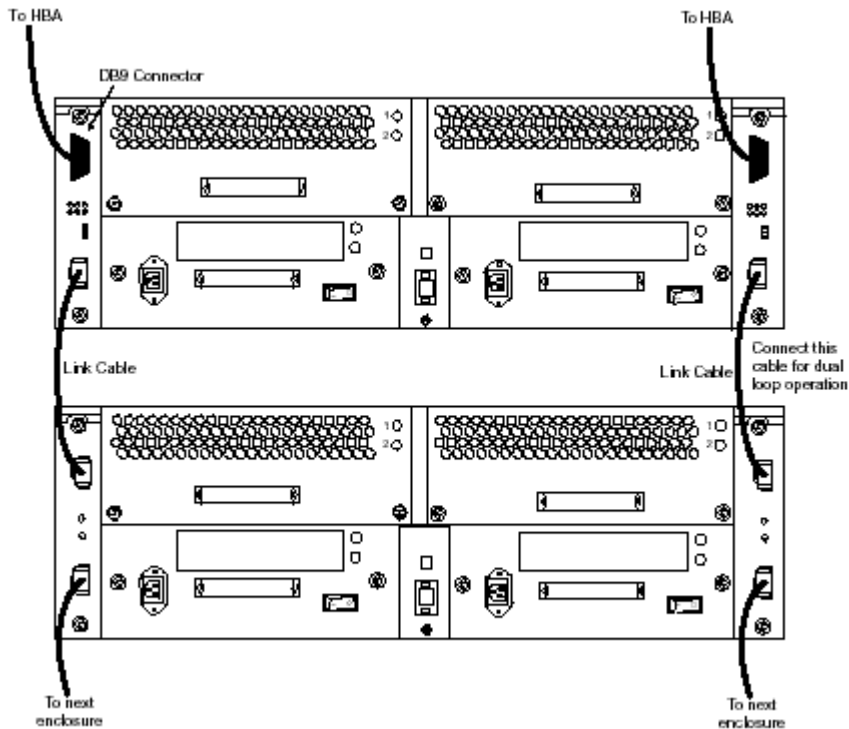
4.5.3.2 Daisy Chained Single RAID Controller



4.5.3.3 Dual RAID Controllers



4.5.3.4 Daisy Chained Dual RAID Controllers



4.6 Tape Subsystem

ftServer 5200 systems support DLT 8000 and DDS-4 tabletop tape drives. No drives are mounted in the storage enclosure. Tape drives are controlled by the U516 QLA1080 SCSI controllers configured as a single-initiators. Each U516 can support two tape drives daisy chained together..

Each tape drive must have a unique SCSI ID assigned. Failure to do so will create SCSI bus conflicts.

4.6.1 DDS-4 Tape Drive

The DDS-4 tape drive is the 4th generation of DDS products. DDS-4 has all of the benefits of previous DDS products with faster transfer speeds (3-6 MB/sec sustained), higher capacity and increased reliability. To achieve the speed and capacity benefits, DDS-4 150M media must be used. Cartridge capacity is 20 MB per cartridge native (40 MB per cartridge assuming 2:1 data compression). Previously archived data is easily accessible with read/write backward compatibility. The drives implement the LVD interface. DDS-4 drives are available on ftServer 5200 systems in both a single-cartridge mechanism and a 6 to 8-cartridge magazine autoloader configuration.

4.6.2 DLT 8000 Tape Drive

DLT 8000 is the 4th generation of DLT products. Native transfer speed for the DLT 8000 product is 6MB/s native (up to 10MB/s w/compression). Cartridge capacity is 40MB per cartridge native (80MB per cartridge assuming 2:1 data compression). To achieve the speed and capacity, DLT Tape IV media must be used. Previously archived data is accessible with backward read/write compatibility. The drives implement the LVD interface. DLT 8000 drives are available on ftServer 5200 systems in both a single-cartridge mechanism and autoloader configurations.

4.6.3 Tape Drive Configuration

The tape drive enclosure has two 68-pin Wide SCSI .050 series socket connectors that support a cable-in, cable-out daisy-chaining configuration or a cable-in and terminate configuration. There is a switch on the back of the enclosure that allows the selection of the device's SCSI ID.

The tape drive power supply is auto ranging to support 110-240 VAC and 47-63 Hz. A power switch is located on the back of the tape drive.

4.6.4 Tape Drive Termination

A tape drive is terminated externally if the drive is the last device on the SCSI bus. The terminator is a 68-pin SCSI-3, single-ended, low voltage differential, auto-switching multi-mode terminator.

4.6.5 Tape Drive Cabling

The maximum cable length for an LVD SCSI bus is 12 meters (approx. 39 ft.). The SCSI bus cable for the tape drives is available in three lengths: 12 ft., 20 ft., and 36 ft.

The cable connects from the U516 controller to an external tape drive. If this is the only tape drive on the bus, it must be terminated by an external terminator. If a second tape drive is daisy chained to the first, it must be

terminated since it is the last drive on the SCSI bus.

4.7 Power Subsystem

The power system topology consists of multiple integrated AC-DC power supplies. These power supplies are co-located with the major system elements. Due to the overall system redundancy, there is no requirement for an N+1 topology for power within the CPU enclosure or PCI console shelf. The disk shelf has N+1 power because it is a shared system resource. The power for the PCI console shelf is partitioned into A SIDE and B SIDE power. Each side provides power for a core and expansion I/O enclosure.

The power system operates from 120-240 VAC RMS, 47 to 63 Hz. The AC source can have no greater than 10% Harmonic distortion. There is no requirement for brownout protection.

The power connection to the AC mains is made by use of detachable "country cord kits." In the base configurations of a DMR and TMR system, this requires two power cords connected to two independent AC sources and two exclusive branch circuits. A system configuration that consists of a DMR or TMR and a storage expansion cabinet requires four power cords connected to two independent AC sources and four exclusive branch circuits.

4.8 Cooling Subsystem

4.8.1 PCI Subsystem

A fan is located in the rear of each I/O enclosure. It operates at one speed, drawing air from the PCI console into the I/O enclosure. The forced air then travels from the back of the I/O enclosure to the front and is expelled through the I/O enclosure' perforated top cover. If a fan breaks, the I/O enclosure will break and need replacement.

5. Upgrades

5.1 CPU Upgrades

The following table lists the upgrades available for ftServer systems.

Model No.	Type	SMP	Processor
UPC3501	DMR to TMR	1-way to 1-way	750 MHz/512 KB Cache
UPC3502	DMR to TMR	2-way to 2-way	750 MHz/512 KB Cache
UPC3503	DMR to DMR	1-way to 2-way	750 MHz/512 KB Cache
UPC3504	TMR to TMR	1-way to 2-way	750 MHz/512 KB Cache

5.2 CPU/Memory Upgrade Procedure

This section describes the steps needed to install a CPU or memory upgrade into a customer's ftServer 5200 system in the field.

CAUTION: ESD protection must be maintained for all parts of this process where the ESD covers have been removed from the CPU enclosure.

In order to upgrade the CPU/memory modules on the motherboard board, the components on the board must be at compatible revision levels. The configuration rules shown in this document are based on information available at the time of publication.

NOTE: This procedure is optimized to minimize system downtime.

5.2.1. Preliminary Verification

Before starting a processor or memory upgrade, verify the following:

- For every processor to be installed there is a voltage regulator module (VRM) to be installed in the corresponding slot.
- Memory modules/processors to be added or used as replacement components are of identical capacities and will occupy the same slots in all CPU enclosures.
- Access to a PC that has web access.

5.2.2. ESD Requirements

Since many of the components on the motherboard are particularly susceptible to ESD (Electro-Static

Discharge), the board must be protected from ESD. ESD protection kits must be employed when doing reconfigurations of CPU enclosures.

The CPU/memory modules must also be protected from ESD before they are removed from their ESD-protected packaging, and while being handled.

To prevent equipment damage while handling components, take the following ESD precautions:

- A securely fastened ESD wrist strap **MUST** be worn at all times when removing the components.
- Avoid touching a component's leads or contacts.

Set up the ESD protection kit as close to the system as possible. Instructions for setting up the rubberized mat, grounding wrist strap, etc. are supplied with the kit.

5.2.3. Upgrade Procedure

5.2.3.1 Bring Down the CPU Enclosure

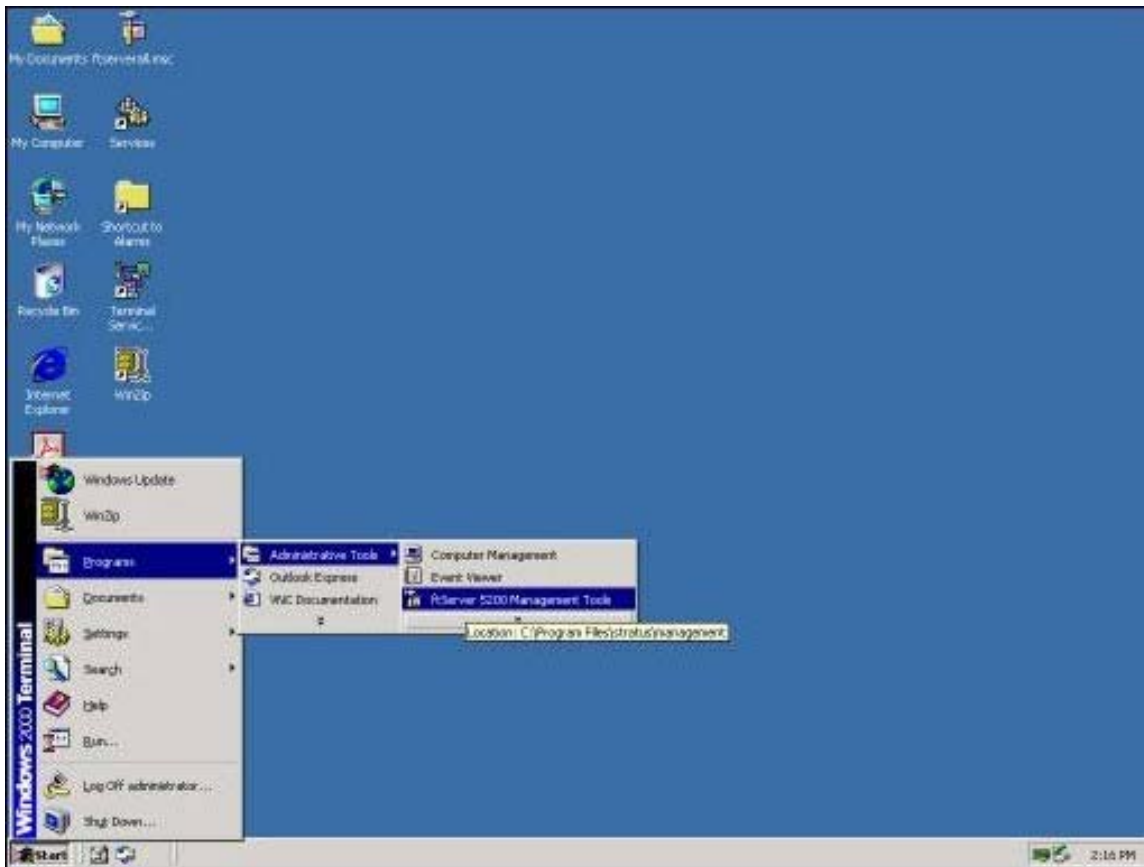
1. From the **Start menu** (Figure 1.) navigate to

Programs

Administrative Tools

ftServer Management Tools

Figure 1.



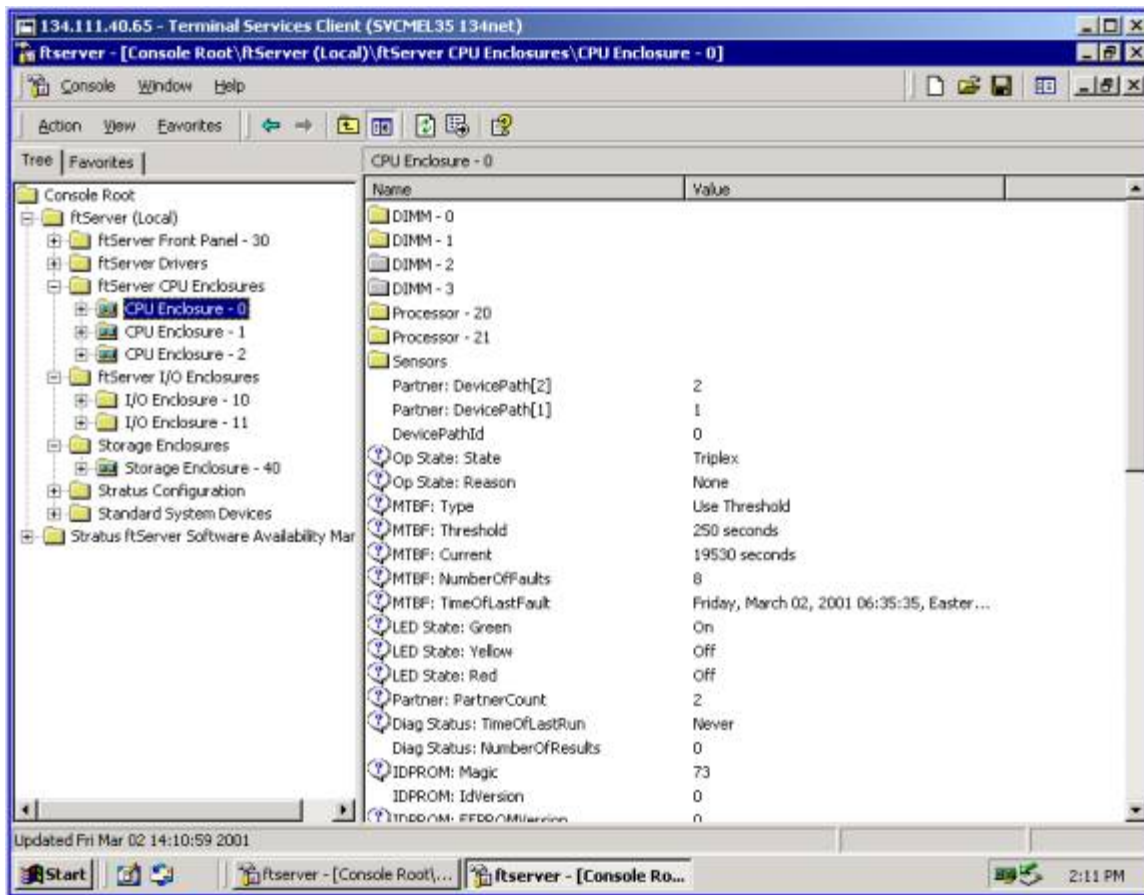
2. Select **ftServer (local)** (Figure 2.) and navigate to

ftServer CPU Enclosures

CPU Enclosure - 0

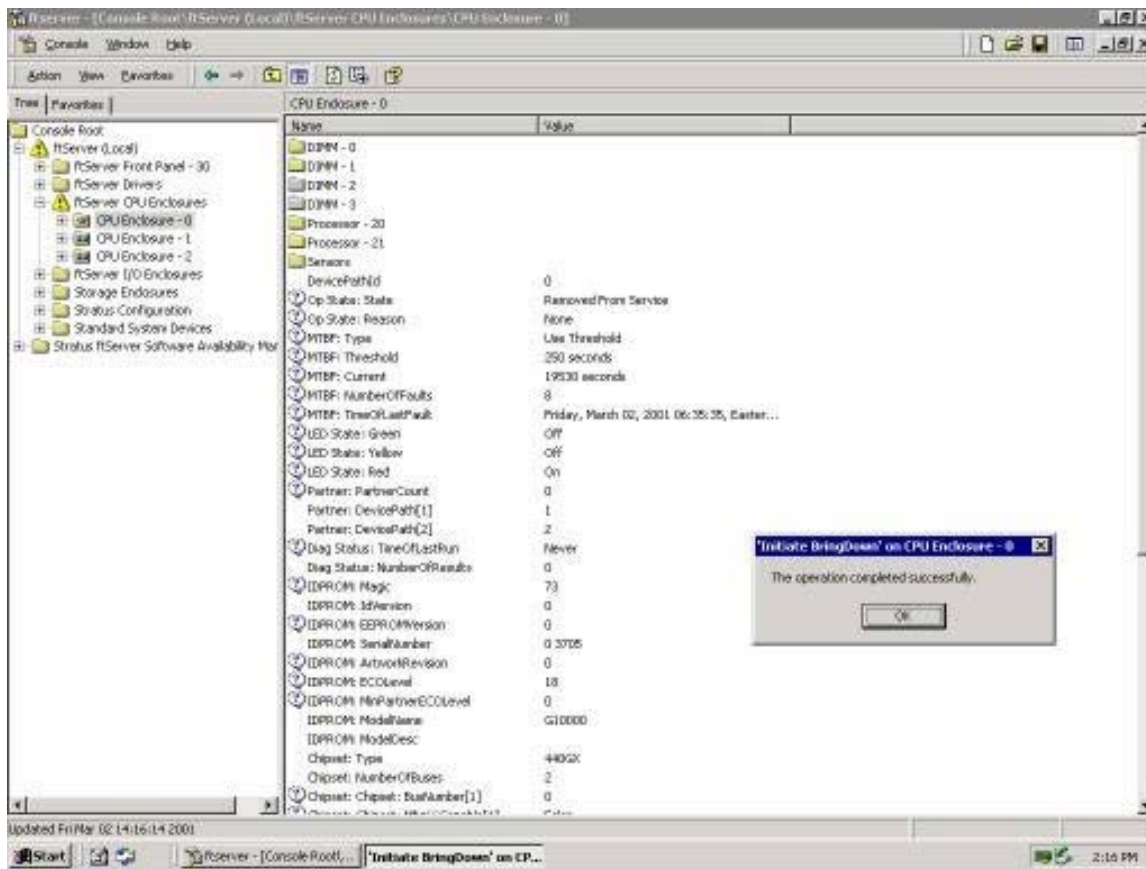
The status of the CPU appears in the right pane.

Figure 2.



3. Right click on **CPU Enclosure - 0**. The **Action** menu appears. (Figure 3.)

Figure 3.



5.2.3.2 Memory/Processor Removal/Replacement

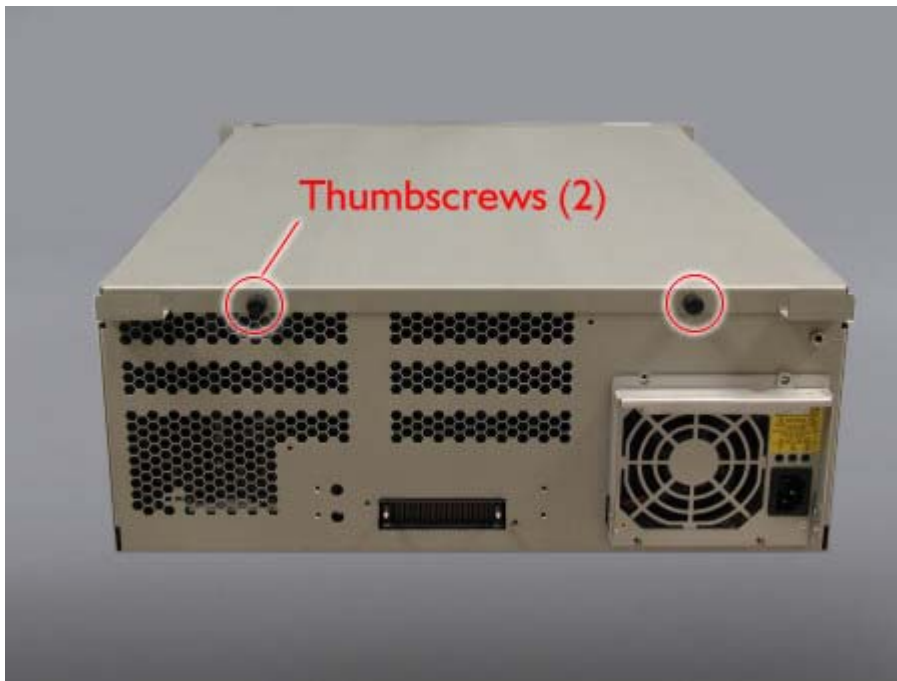
Perform Section 3.2.1 and/or Section 3.2.2 to physically upgrade the CPU Enclosure.

5.2.3.2.1 Memory Modules

1. Remove CPU Enclosure 0 (CRU).
2. Loosen the two thumbscrews securing the cover at the rear of the CPU enclosure. Slide the cover toward the rear to disengage the catches, then lift the cover off the enclosure. (Figure 5.)

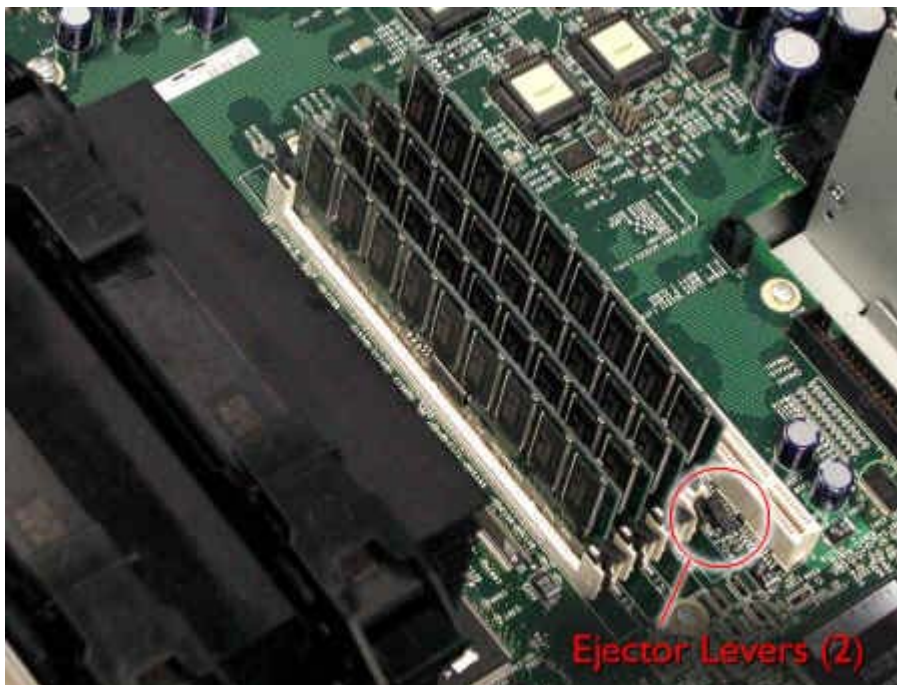
NOTE: A banana jack is provided at the rear of the chassis to connect the ESD strap.

Figure 5.



3. Push down to release the memory module's ejector levers and pull the module straight out from the connector. (Figure 6.)

Figure 6.



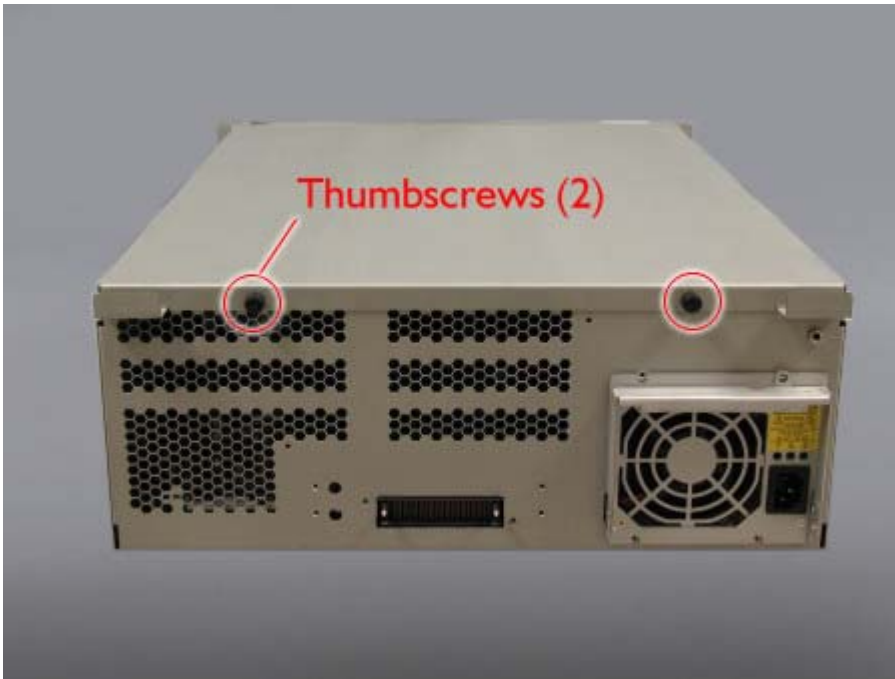
4. Carefully insert the new module into the connector making sure it is seated properly. Start with slot 0.
5. Close the ejector levers.

5.2.3.2.2 Processors

1. Remove CPU Enclosure 0 (CRU).
2. Loosen the two thumbscrews securing the cover at the rear of the CPU enclosure. Slide the cover toward the rear to disengage the catches, then lift the cover off the enclosure. (Figure 7.)

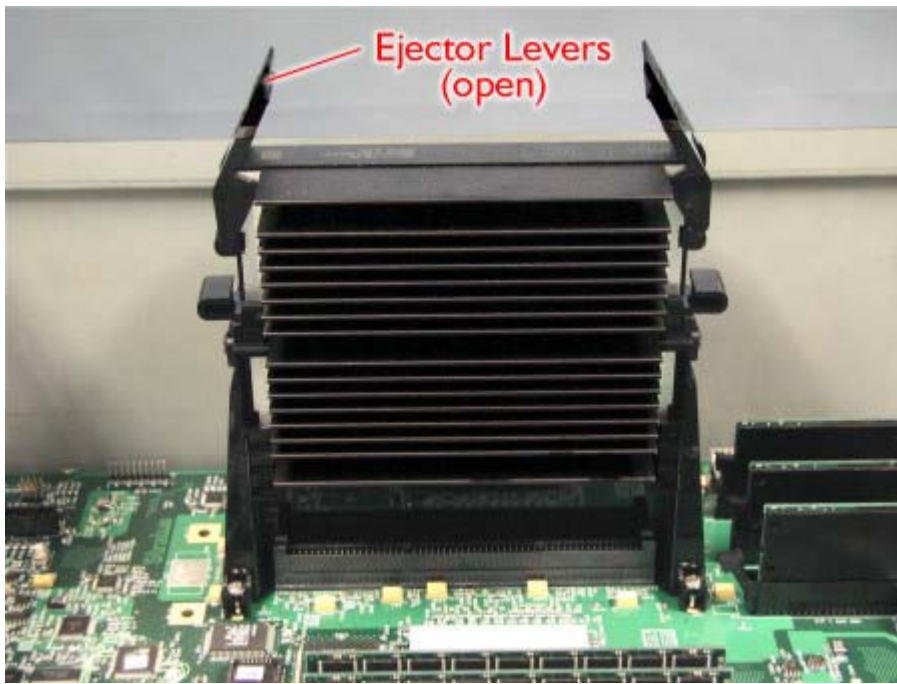
NOTE: A banana jack is provided at the rear of the chassis to connect the ESD strap.

Figure 7.



3. Release the processor's ejector levers and pull the processor straight up and out from the connector. (Figure 8.)

Figure 8.



4. Open the new processor's ejector levers. Make sure the ejector levers' lower ends engage the tabs at the top of the processor connector such that, when lowered, the levers will secure the processor in place.
5. Carefully insert the new processor into the connector making sure it is seated properly. Begin with slot 0.
6. Close the ejector levers completely, making sure the levers engages the top of the processor to ensure secure connection.

IMPORTANT: There is a voltage regulator module (VRM) connector for each processor connector in the CPU enclosure. Be sure that each installed processor has a VRM installed in the corresponding connector.

5.2.3.3 Shut Down Windows 2000

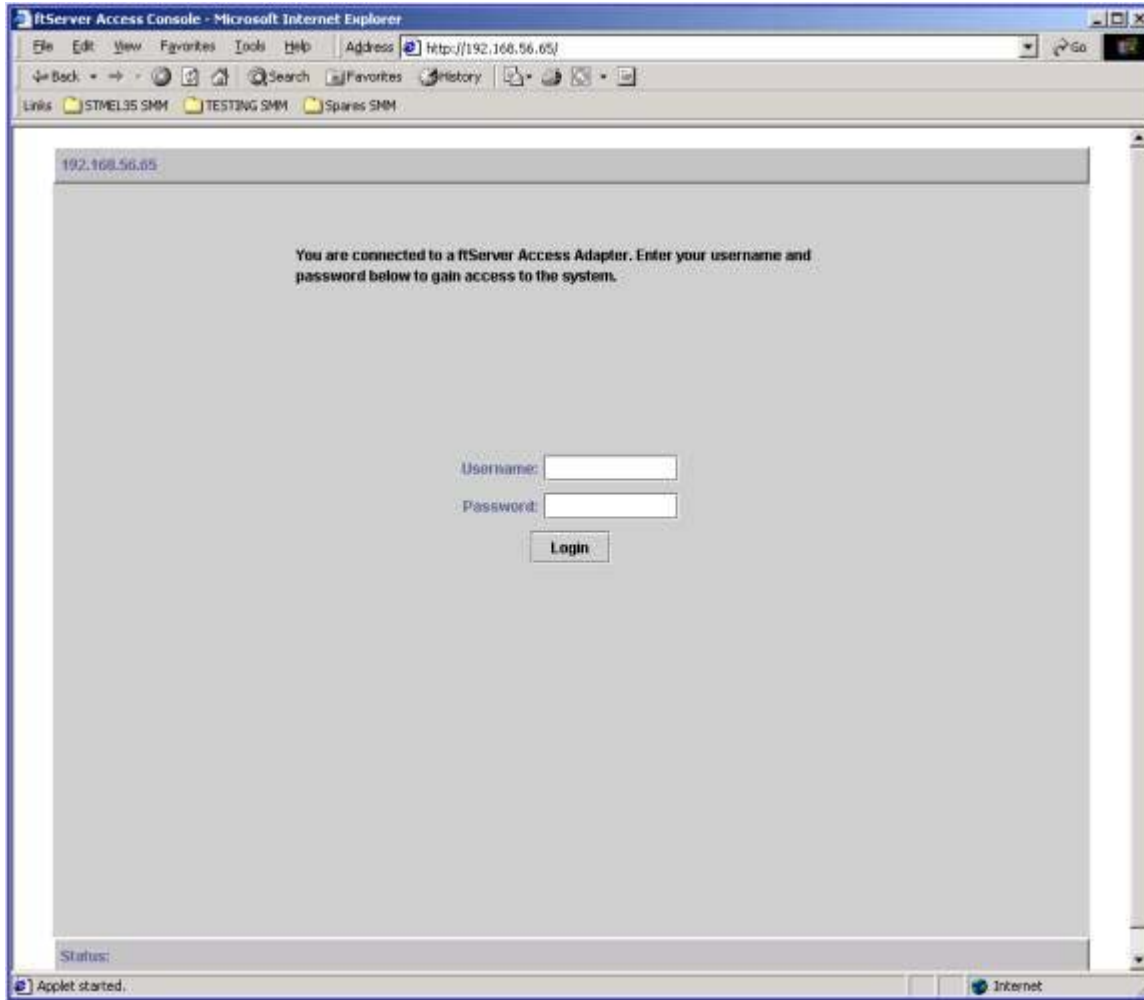
1. Reinstall CPU enclosure 0 in the system and reconnect the CPU-to-Console Shelf cable, but leave the enclosure's power cable unplugged.
2. Shutdown Windows 2000.

5.2.3.4 Switch CPU Enclosures and Boot the System

1. Disconnect the CPU-to-Console Shelf cable(s) and power cable(s) on CPU Enclosure 1 (and CPU enclosure 2, if this is a TMR system).
2. Reconnect the power cable on CPU enclosure 0.
3. Open a browser on a PC that has access to the ftServer Access adapter. Enter the URL of the ftServer Access adapter in Core I/O chassis 10. This will bring up the **ftServer Access Console** login screen. (Figure 9.)

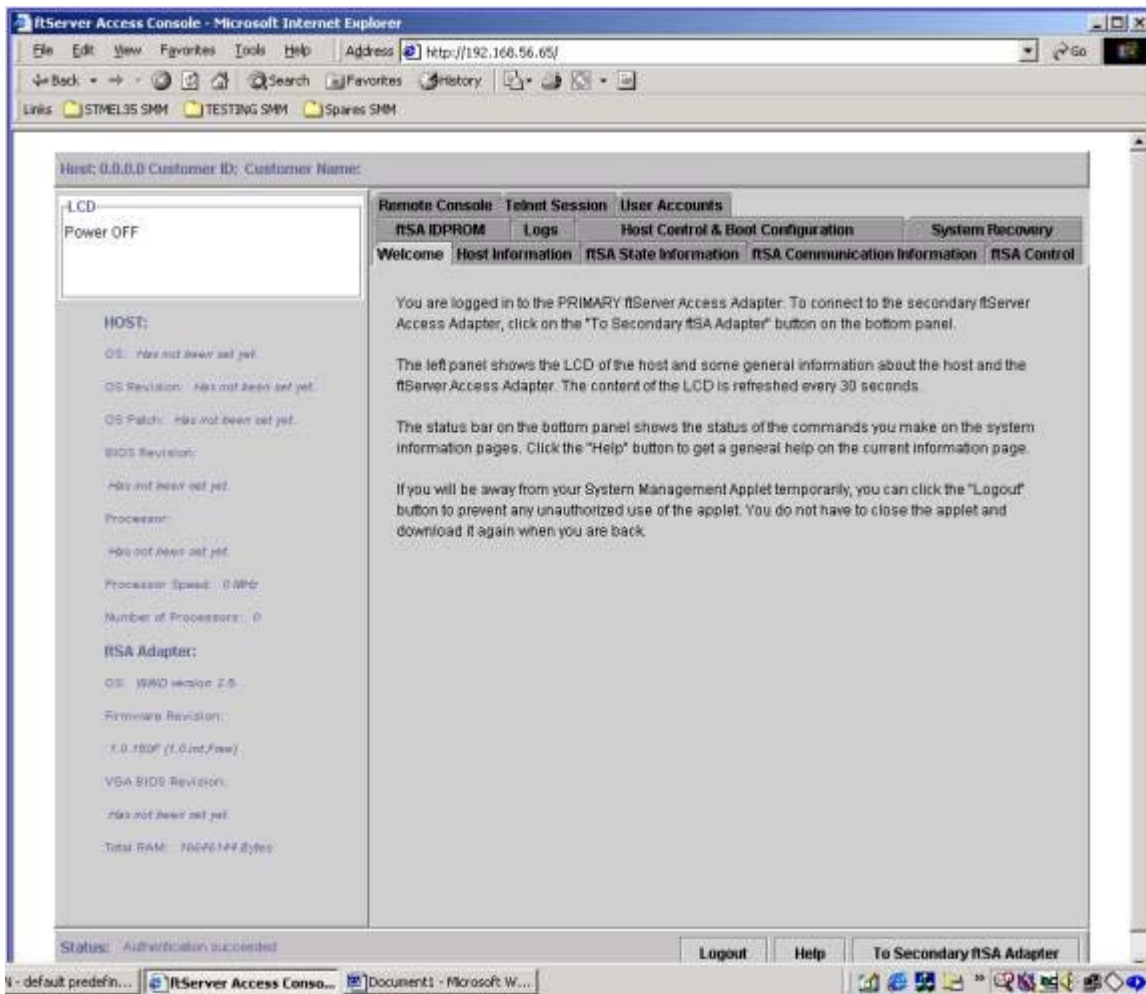
NOTE: If the **ftServer Access Console** is not available, you can power off the system by pressing the power button on the Front Panel for five seconds. Then, when Power Off is seen in the LCD, power on the system by pressing the power button for five seconds.

Figure 9.



4. Login and when the **ftServer Access Console** screen appears click on the **Host Control and Boot Configuration** tab. (Figure 10.)

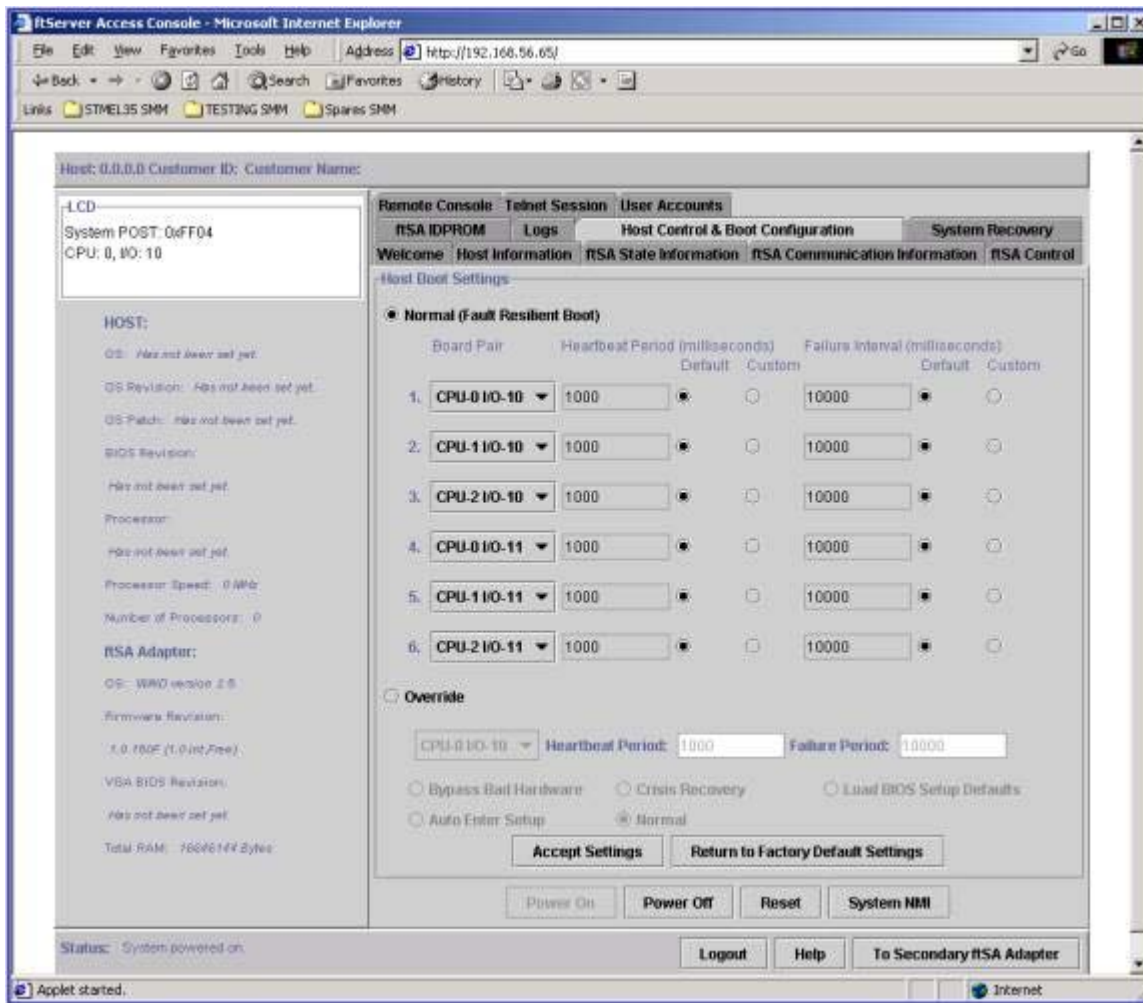
Figure 10.



5. Press **Reset** to reboot the system from CPU enclosure 0. (Figure 11.)

NOTE: If the system fails to reboot, check the **POST** codes on the front panel LCD for the cause. Reboot failures are likely to be caused by loose connections in the recently added processors or memory modules.

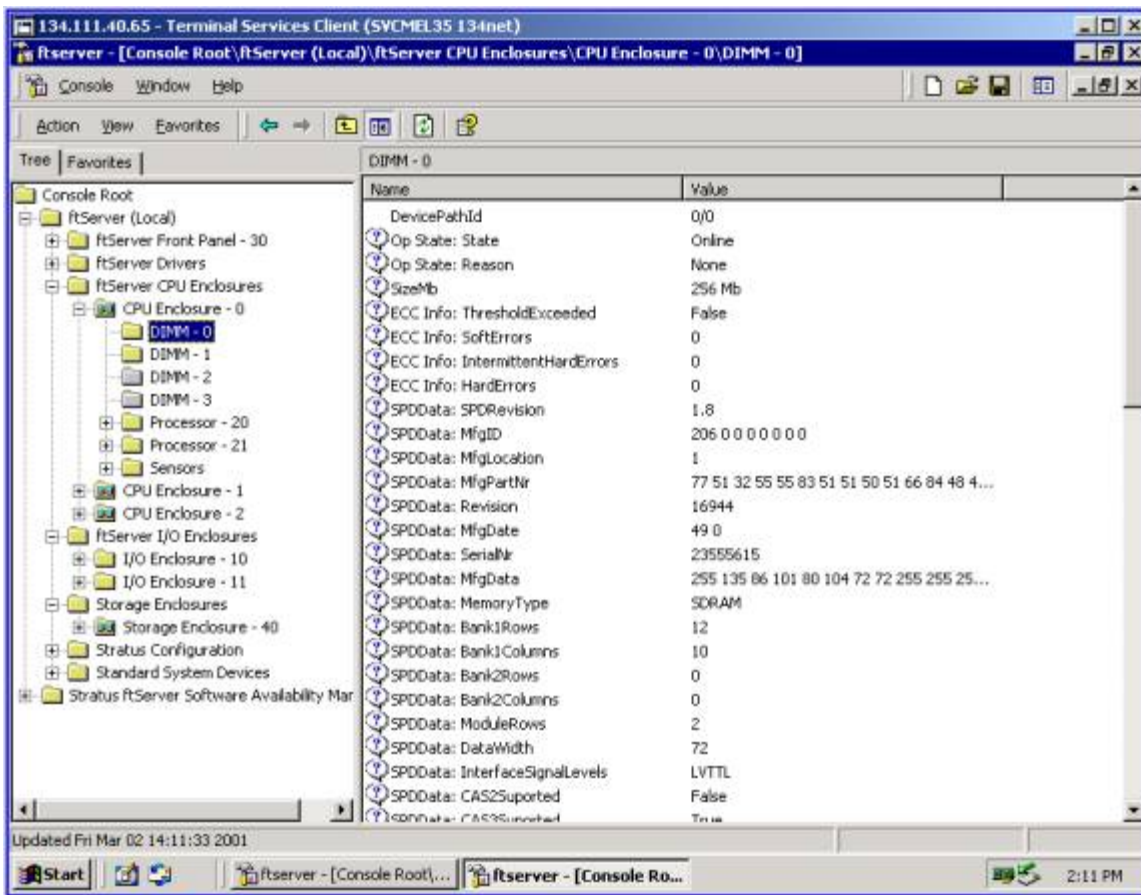
Figure 11.



5.2.3.5 Upgrade Remaining CPU Enclosure(s) and Verify System Operation

1. While the system is rebooting from CPU enclosure 0, remove and upgrade the CPU enclosure 1 (and CPU enclosure 2, if this is a TMR system) as described in Section 3.2.
2. Go to the **ftServer Management Console** and verify that the upgraded memory/processor information appears for CPU enclosure 0. (Figure 12.)

Figure 12.



3. Reinstall CPU enclosure 1 (and CPU enclosure 2, if this is a TMR system). Reconnect the CPU-toPCI Console Shelf cable(s), and then reconnect the power cable(s).
4. In the **ftServer Management Console** verify that all CPU enclosures are upgraded and online.

5.3 Storage Enclosure Upgrade


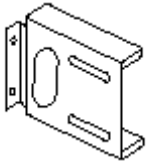
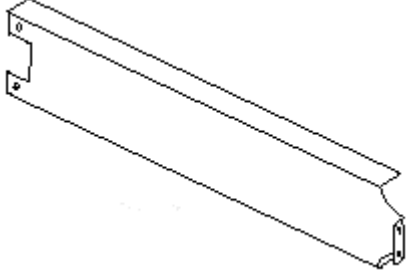





5.3.1. Installing a Storage Enclosure

Before a storage enclosure can be installed in an ftServer cabinet, the rail kit supplied must be installed in the cabinet. Once the rail kit is in place the storage enclosure can be installed.

5.3.1.1 Installing the Rail Kit

The rail kit contains the components shown in the following table:

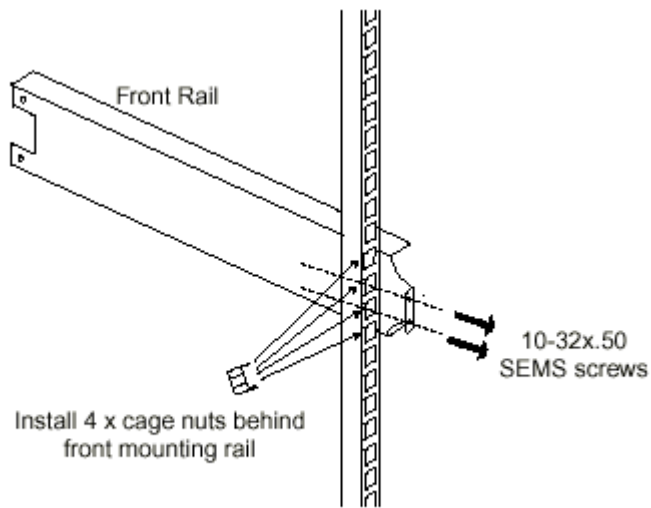
Component	Description	Quantity
	Rack Mount Kit Flange	2

		
	Rear Rail	2
	Front Rail	2
	10-32 Cage Nut	12
	6-32.38 Flat Head Screw	4
	Phillips Pan Head Screw - SEMS 10-32x.50	8
	Phillips Pan Head Screw - SEMS 10-32x.31	4
	Phillips Truss Head Screw - 10-32x.75	4

Once you have verified that all the components are in the kit you are ready to begin the installation.

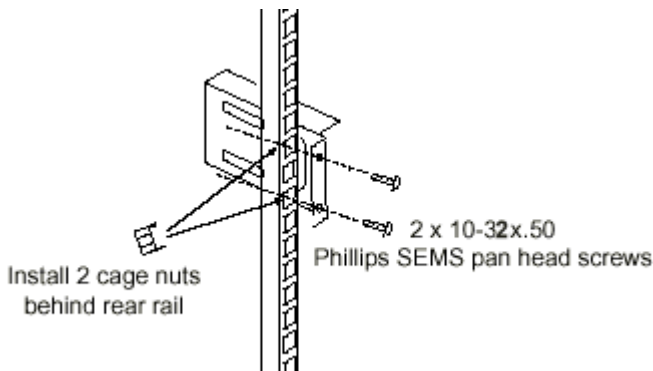
1. Select the location in the cabinet where the storage enclosure is to be installed.
2. Insert the 4 cage nuts on each front rail as shown in Figure 1. Install both front rails to the front cabinet rail using 2 x 10-32x.50 SEMS screws supplied. Make sure they are installed in the two **inner** holes as shown.

Figure 1. Left Side Front Rail.



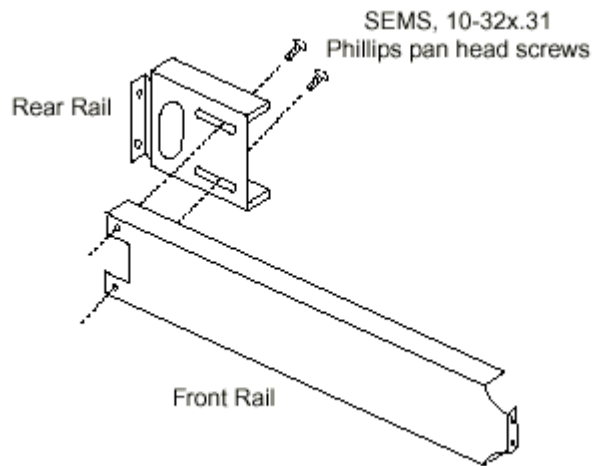
3. Insert the 2 cage nuts on each rear rail as shown in Figure 2. Install both rear rails using 2 x 10-32x.50 SEMS screws supplied.

Figure 2. Left Side Rear Rail.



4. When front and rear rails are in place, secure the front rails to the rear rails using the SEMS, 10-32x.31 Phillips pan head screws supplied. (See Figure 3.)

Figure 3. Left Side Front Rail Secured to Left Side Rear Rail.



5. Tighten all the screws to complete the rail kit installation.

5.3.1.2 Installing a Storage Enclosure into the rails

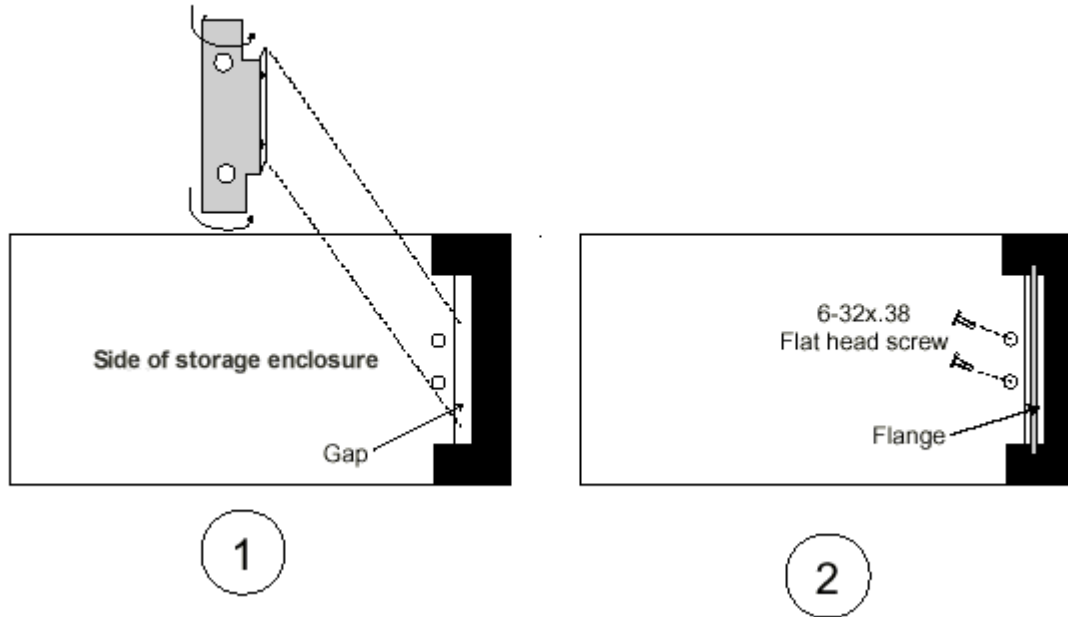
1. Install the mounting rails as described above.

2. Before the storage enclosure can be installed in the rails, the Rack Mount Kit Flanges need to be fitted to the storage enclosure. To do this the flange needs to be inserted into the gap on the side of the storage enclosure as shown in Figure 4 (1). Once inserted into the storage enclosure, the flange needs to be rotated forward so that the screw holes on the storage enclosure line up with the screw holes on the flange. Secure the flange in place using the 6-32x.38 flat head screws supplied as shown in Figure 4 (2).

The following illustration shows how to install the flange.

Figure 4. Flange Installation.

Insert flange this way and rotate forwards



3. Onto the mounting rails install the storage enclosure and secure it in place using the four 10-32x.75 Phillips truss head screws provided. (See Figure 5.) Make sure they are installed in the two **Outer** holes as shown.

Figure 5. Holes for Storage Enclosure Installation.

4. Tighten the screws.

5.3.2 Removing a Storage Enclosure

1. Shut down the host system and turn off the power.
2. Turn off the storage enclosure power switch and disconnect the shelf power cords.
3. Disconnect all cables from the rear of the shelf.
4. Remove the four 10-32x.75 Phillips truss head screws from the front of the storage enclosure.
5. Slide the storage enclosure out of the rack rails.

6. Related Documentation

6.1 Customer Service Documentation

ftServer 5200 Hardware Installation Guide

ftServer 5200 Illustrated Parts Catalog

ftServer 5200 Remote Request Client (RRC) User Guide

ftServer Connection Client (CxC) User Guide

6.2 Customer Documentation

ftServer 5200 Site Planning Guide (R457)

ftServer 5200 Operation and Maintenance Guide (R459)

ftServer 5200 CRU Reference Manual (R460)

ftServer 5200 PCI Installation and Servicing Guide (R461)

ftServer 5200 Storage Components User Guide (R462)

ftServer 5200/Windows 2000: Fault Tolerant System Administration (R001W)

ftServer 5200/Windows 2000: Software Installation and Configuration (R002W)

ftServer 5200/Windows 2000: ftServer Access Adapter Remote Management Guide (R003W)

ftServer 5200/Windows 2000: Release Notes (R004W)

ftServer 5200/Windows 2000: RAM Disk User Guide (R005W)

ftServer 5200/Windows 2000: Persistent Memory Programming Guide

ftServer 5200/Windows 2000: Software Availability Manager User Guide (R007W)

ftStorage Fibre Channel Array Installation Guide (R503-00)

6.3 Engineering Documentation

Stratus Configuration Specification Document No. ES-000123 Stratus ftServer 5200

System Configuration Documentation Process (SED-1936)

7. Part Numbers

The tables in the following subsections list the part numbers for the Customer Replaceable Units (CRUs), Field Replaceable Units (FRUs), and Distributor Replaceable Units (DRUs) in ftServer 5200 systems.

7.1 CPU Enclosure

Description	CRU/FRU/DRU	Part Number
CPU Enclosure (no memory or CPU)	CRU	AA-G11020
CPU Enclosure (no memory or CPU)	CRU	AA-G11030
CPU Power Supply	CRU	AA-P41000
CPU Fan Pack	CRU	AA-E23300
CPU-to-PCI Console Cable	CRU	AW-020085
256-MB Memory Module	FRU	AA-M22300
512-MB Memory Module	FRU	AA-M22200
Processor (750 MHz, 256 KB cache)	FRU	AS-000380
CPU Motherboard	DRU	AA-G10020
CPU Motherboard	DRU	AA-G10030
Voltage Regulator Module (VRM)	DRU	TA-000103

7.2 PCI Console Shelf

Description	CRU/FRU/DRU	Part Number
Front Panel	CRU	AA-E83300
PCI Console Shelf Power Supply	CRU	AA-P41000
Clock Card	CRU	AA-E83100
Core I/O Enclosure	CRU	AA-E83400
Expansion I/O Enclosure	CRU	AA-E83500
PCI Slot Filler Panel	CRU	F9-000583
ftServer Access Adapter	CRU	AA-U46010
1-port Ethernet Adapter	CRU	AA-U51500
1-port Ultra2 SCSI Adapter	CRU	AA-U51600
2-port Ultra2 SCSI Adapter	CRU	AA-U51900
PCB, Intel pro/1000 F Server Adapter 1000base-sx (Fiber Gigabit)	CRU	AA-U57000
PCB, Intel pro/1000 T Server Adapter (Copper Gigabit)	CRU	AA-U57100
PCB, 2-Port Sync Adapter	CRU	AA-U48000
PCB, 4-Port Sync Adapter	CRU	AA-U48500
PCB, 8-Port Async Adapter	CRU	AA-U48600

SCSI V short cable	CRU	AW-001079-01
CSCIV Long Cable	CRU	AW-001079-02
CBL, V.35 Sync Cable	CRU	AW-B40000
CBL, V.24/EIA-232 Sync Cable	CRU	AW-B40100
CBL, EIA-530 Sync Cable	CRU	AW-B40200
CBL, V.36/EIA-449 Sync Cable	CRU	AW-B40300
CBL, V.11/X.21 Sync Cable	CRU	AW-B40400
ftServer Access Adapter 56K Modem	CRU	AA-C51900
LVDS I/O Power and Distribution Board	DRU	AA-E83000
Peripheral Bus Interconnect PCB	DRU	AA-E15300
IDE Bus PCB	DRU	AA-E15600
High-capacity Floppy Drive	DRU	AA-D56002
CD-ROM Drive	DRU	AA-D55001
Keyboard (USB)	CRU	AA-V11510
Mouse (serial)	CRU	AA-V11610
VGA 15" Color Monitor with Power Cord	CRU	AA-V10610
1U Monitor, Keyboard, Mouse Assembly	CRU	AA-V12500
CBL, UL/CSA 6 ft VGA Cable	CRU	AW-B20240
CBL, UL/CSA 6 ftUSB Cable	CRU	AW-B51100
SCSI cable (68 Pos.SCSIU to 0.8 mmVHD Ext. SCSI)	CRU	AW-001046-01

7.3 SCSI Storage Subsystem

Description	CRU/FRU/DRU	Part Number
SCSI Storage Enclosure Shell	FRU	AA-D52000
SCSI Storage Enclosure with 1 Repeater-Enclosure Services Module	FRU	AA-D51002
SCSI Storage Enclosure Power Supply	CRU	AA-P51000
Repeater-Enclosure Services Module (RESM)	FRU	AA-E51100
I/O Terminator Module	FRU	AA-E51200
SCSI Storage Enclosure Fan	CRU	MF-000038
18-GB Disk Drive (10K RPM)	CRU	AA-D51210
18-GB Disk Drive (10K RPM)	CRU	AA-D51220
18-GB Disk Drive (15K RPM)	CRU	AA-D51800
36-GB Disk Drive (10K RPM)	CRU	AA-D51310
36-GB Disk Drive (10K RPM)	CRU	AA-D51320
73-GB Disk Drive (10K RPM)	CRU	AA-D51700
Disk Slot Filler Panel	CRU	AX-000351

7.4 Tape Subsystem

Description	CRU/FRU/DRU	Part Number
DDS-4 DAT Tape Drive	CRU	AA-T51100
DDS-4 DAT Tape Drive with Autoloader	CRU	AA-T51200
DLT 8000 Tape Drive	CRU	AW-T51300
SCSI Cable (to first tape drive - 10 ft/30 ft)	CRU	AW-001046-01/02
SCSI Cable (daisy chain to 2nd tape drive-3 ft)	CRU	AW-001072
SCSI Terminator LVD/SE Multi Mode	CRU	AW-T50004

7.5 Power Cords

European Power Cord (250 VAC, 10 Amp, CEEE 7 VII)	CRU	AW-B50109-25M AW-B50110-03M AW-B50111-35M AW-B50112-45M
British Power Cord (250 VAC, 10 Amp, BS1363/A)	CRU	AW-B50113-25M AW-B50114-03M AW-B50115-35M AW-B50116-45M
Italian Power Cord (250 VAC, 15 Amp, CEI 23-16)	CRU	AW-B50133-25M AW-B50134-03M AW-B50135-35M AW-B50136-45M
Australian Power Cord (250 VAC, 15 Amp, AS/NZS 3112-1993)	CRU	AW-B50121-25M AW-B50122-03M AW-B50123-35M AW-B50124-45M
Swiss Power Cord (250VAC, 15 Amp, 1011-S24507)	CRU	AW-B50137-25M AW-B50138-03M AW-B50139-35M AW-B50140-45M
Japanese/U.S. Power Cord (20 VAC, 15 Amp, NEMA 5-15)	CRU	AW-B50149-07 AW-B50150-10 AW-B50151-12 AW-B50152-15
Japanese/U.S. Power Cord Set (120 VAC, 15 Amp, NEMA 5-15)	CRU	AW-B50101-07 AW-B50102-10 AW-B50103-12 AW-B50104-15
Japanese/U.S. Power Cord Set (250 VAC, 13 Amp, NEMA 6-15)	CRU	AW-B50105-07 AW-B50106-10 AW-B50107-12

		AW-B50108-15
Israeli Power Cord (250VAC, 15 Amp, SI 32/1971)	CRU	AW-B50129-25M AW-B50130-03M AW-B50131-35M AW-B50132-45M
Danish Power Cord Set (250VAC, 15 Amp, DK2-1a/1992)	CRU	AW-B50141-25M AW-B50142-03M AW-B50143-35M AW-B50144-45M
Danish Power Cord Set (250VAC, 15 Amp, DK2-5a/1992)	CRU	AW-B50145-25M AW-B50146-03M AW-B50147-35M AW-B50148-45M
South Africa Power Cord (250 VAC, 10 Amp.,ZA/3)	CRU	AW-B50149-25M AW-B50150-03M AW-B50151-35M AW-B50152-45M
Power Cable Wire (10 Amp.)	CRU	AW-B50117-25M AW-B50118-03M
Power Cable Wire(15 Amp.)	CRU	AW-B50119-07 AW-B50120-10
Monitor Cable to Cabinet Power Strip	CRU	AW-B50500-15M
Cabinet Ground Cable	CRU	AW-001075
UPS MX 5000 Cable to Bottom Power Strip (NEMA 5-15)	CRU	AW-B50101-07
UPS MX 5000 Cable to Top Power Strip (NEMA 5-15)	CRU	AW-B50102-10
UPS MX 5000X Bottom Power Strip IEC320-2-2/E (C14)]	CRU	AW-B50300-25M
UPS MX 5000W Cable to Top Power Strip [IEC320-2-2/E (C14)]	CRU	AW-B50301-35M
Power Strip (120V/15A)	FRU	AW-P41100
Power Strip (240V/10A)	FRU	AW-P41101

7.6 Fibre Channel Storage Subsystem

Description	CRU/FRU/DRU	Part Number
Blank Disk Slot Cover	CRU	AA-000382
3U - 14-slot rackmount raid array shelf, dual RAID controllers each with 128 MB of ECC (error-correcting-code) cache and a battery, dual PSMs with dual AC inputs, dual ACMs and dual LSMs. Includes 7 disk drive blanks, RAID configuration software, SAN mapping (LUN masking), as well as user documentation, and	CRU	AA-D57000

rackmount rail kit. Model does not include disk drives. Two 3 meter FC Copper Cables (with DB9 male to HSSDC, non equalized Connections) for fibrechannel HBA to raid controllers are included.		
Fibre Channel RAID Controller 2/ 128MB Cache	CRU	AA-D57100
Fibre Channel Subsystem LS Module	CRU	AA-D57200
36-GB 10,000RPMFibre Channel drive	CRU	AA-D57400
73-GB 10,000RPMFibre Channel drive	CRU	AA-D57500
3U 14-slotrackmount raid array shelf, dual copper I/O modules, dual PSMs with dual AC inputs, dual ACMs and dualLSMs. Includes 7 disk drive blanks and rackmount rail kit. Model does not include disk drives in carriers.	CRU	AA-D58000
Fibre Channel I/O Module	CRU	AA-D58100
Fibre Channel Subsystem Power Supply Module	CRU	AA-P57000
Qlogic Fibre Channel PCI Controller	CRU	AA-U51400
Rail kit for RACK MOUNTING FC2100	CRU	AK-000385
1M Power Cord (internal 5200) (black) Connects to A side (left) of power strip	CRU	AW-B50200-01M
1M Power Cord (internal 5200) (gray) Connects to B side (right) of power strip	CRU	AW-B50201-01M
Fibre Channel 3-meter DB9-HSSDC Cable	CRU	AW-B50700
0.5meters, HSSDC to HSSDC, non-equalized - Expansion Enclosure Cables	CRU	AW-B50800
Fibre Channel 10-meter DB9-HSSDC Cable	CRU	AW-B50900
USA Standard AC Power Cord for 24U/38U racks and standard racks (2m)	CRU	AW-B51000-01
European standard AC Power cord (2m)	CRU	AW-B51000-02
UK standard AC Power cord (2m)	CRU	AW-B51000-03
Japanese standard AC Power cord (2m)	CRU	AW-B51000-04
Fibre Channel RAID Battery	DRU	BA-000014
Fibre Channel Subsystem Advanced Cooling Module - D580 Module without battery	CRU	MF-000041
Fibre Channel Subsystem Advanced Cooling Module - D570 Module with battery	CRU	AS-000387
Australia standard AC Power cord (2m)	CRU	307-00018-000
Israel standard AC Power cord (2m)	CRU	307-00015-000
South African AC Power Cords (2m)	CRU	TBD
D570 Enclosure withoutCRUs, cables, or mounting hardware (Backplane replacement)	FRU	TBD

Appendix A. Power Cables

A.1 External Power Cords

Country	Wall Plug Type	Connector Type	Part Number	Length m/ft
US Domestic 120V/15A (Chicago)	NEMA 5-15	C13	AW-B50101-07	7'
US Domestic 120V/15A (Chicago)	NEMA 5-15	C13	AW-B50102-10	10'
US Domestic 120V/15A	NEMA 5-15	C13	AW-B50103-12	12'
US Domestic 120V/15A	NEMA 5-15	C13	AW-B50104-15	15'
US Domestic 250V/10A (Chicago)	NEMA 6-15 (13A)	C13	AW-B50105-07	7'
US Domestic 250V/10A (Chicago)	NEMA 6-15 (13A)	C13	AW-B50106-10	10'
US Domestic 250V/10A	NEMA 6-15 (13A)	C13	AW-B50107-12	12'
US Domestic 250V/10A	NEMA 6-15 (13A)	C13	AW-B50108-15	15'
Continental Europe 250V/10A	CEE 7 VII (10A)	C13	AW-B50109-25M	2.5m
Continental Europe 250V/10A	CEE 7 VII (10A)	C13	AW-B50110-03M	3m
Continental Europe 250V/10A	CEE 7 VII (10A)	C13	AW-B50111-35M	3.5m
Continental Europe 250V/10A	CEE 7 VII (10A)	C13	AW-B50112-45M	4.5m
Great Britain 250v/10A	BS1363/A (10)	C13	AW-B50113-25M	2.5m
Great Britain 250v/10A	BS1363/A (10)	C13	AW-B50114-03M	3m
Great Britain 250v/10A	BS1363/A (10)	C13	AW-B50115-35M	3.5m
Great Britain 250v/10A	BS1363/A (10)	C13	AW-B50116-45M	4.5m
If >200v hard wire needed	No plug (10A)	C13	AW-B50117-25M	2.5m
If >200v hard wire needed	No plug (10A)	C13	AW-B50118-03M	3m
If 120v hard wire needed	No plug (15A)	C13	AW-B50119-07	7'
If 120v hard wire needed	No plug (15A)	C13	AW-B50120-10	10'
Australia 250v/10A	AS/NZS 3112-1993	C13	AW-B50121-25M	2.5m
Australia 250v/10A	AS/NZS 3112-1993	C13	AW-B50122-03M	3m
Australia 250v/10A	AS/NZS 3112-1993	C13	AW-B50123-35M	3.5m
Australia 250v/10A	AS/NZS 3112-1993	C13	AW-B50124-45M	4.5m
Israel 250v/10A	SI 32/1971	C13	AW-B50129-25M	2.5m
Israel 250v/10A	SI 32/1971	C13	AW-B50130-03M	3m
Israel 250v/10A	SI 32/1971	C13	AW-B50131-35M	3.5m
Israel 250v/10A	SI 32/1971	C13	AW-B50132-45M	4.5m
Italy 250v/10A	CEI 23-16	C13	AW-B50133-25M	2.5m
Italy 250v/10A	CEI 23-16	C13	AW-B50134-03M	3m
Italy 250v/10A	CEI 23-16	C13	AW-B50135-35M	3.5m
Italy 250v/10A	CEI 23-16	C13	AW-B50136-45M	4.5m
Switzerland 250v/10A	1011-S24507	C13	AW-B50137-25M	2.5m
Switzerland 250v/10A	1011-S24507	C13	AW-B50138-03M	3m
Switzerland 250v/10A	1011-S24507	C13	AW-B50139-35M	3.5m
Switzerland 250v/10A	1011-S24507	C13	AW-B50140-45M	4.5m

Denmark 250v/10A	DK2-1a / 1992	C13	AW-B50141-25M	2.5m
Denmark 250v/10A	DK2-1a / 1992	C13	AW-B50142-03M	3m
Denmark 250v/10A	DK2-1a / 1992	C13	AW-B50143-35M	3.5m
Denmark 250v/10A	DK2-1a / 1992	C13	AW-B50144-45M	4.5m
Denmark 250v/10A	DK2-5a /1992	C13	AW-B50145-25M	2.5m
Denmark 250v/10A	DK2-5a /1992	C13	AW-B50146-03M	3m
Denmark 250v/10A	DK2-5a /1992	C13	AW-B50147-35M	3.5m
Denmark 250v/10A	DK2-5a /1992	C13	AW-B50148-45M	4.5m

Internal Power Jumpers (from power strip to internal devices)

Color	Wall Plug Type	Connector Type	Part Number	Length m/ft
Black	IEC320-2-2/E (C14)	C13	AW-B50200-01M	1m
Grey	IEC320-2-2/E (C14)	C13	AW-B50201-01M	1m

A.3 UPS

Cables

Model	Wall Plug Type	Connector Type	Part Number	Length m/ft
UPS MX5000	NEMA 5-15	C13	AW-B50101-07	7'
UPS MX5000	NEMA 5-15	C13	AW-B50102-10	10'
UPS MX5000W	IEC320-2-2/E (C14)	C13	AW-B50300-25M	2.5m
UPS MX5000W	IEC320-2-2/E (C14)	C13	AW-B50301-35M	3.5m
UPS MX5000J	NEMA L6-30P	C13 x2	AW-B50400-X1	2.5m/3.5M

A.4 Cabinet Ground Cable for >200VAC cabinets

Wall Plug Type	Connector Type	Cabinet	Part Number	Length m/ft
JL-001085	JL-001085	All =>200v power cabs	AW-001750	15'

Monitor Line Cord

Wall Plug Type	Connector Type	Part Number	Length m/ft
C14	C13	AW-B50500-15M	1.5m

Note: Monitor power cord may need to be added to

customer order if customer supplies own monitor; otherwise the power cord is bundled with the monitor from vendor.

Appendix B. Status LEDs

This section describes the controls, indicators and ports on the following ftServer 5200 components:

- CPU enclosure
- Front panel
- Clock cards
- I/O enclosure
- Storage enclosure
- Fibre Channel enclosure

B.1 CPU Enclosure

B.1.1 Enclosure LEDs

LEDs		Description
Status LEDs		
Red	Bi-color	
Off	Off	No power. The CPU has lost power and cannot light any LEDs.
On	Green	Testing/not configured. The CPU is being tested or has not yet been configured by the operating system. Temporary condition.
On	Yellow	Dumping or testing. CPU contents are being dumped to retrieve information after a crash or the CPU is being tested. Temporary condition.
Off	Yellow	Simplex mode. The CPU is fully functional but is not running in lock-step with a partner CPU.
Off	Green	Duplex/standby mode. The CPU is fully functional, running in lock-step with a partner CPU, and ready to take over if the partner CPU fails.
On	Off	Rejected/broken. The CPU has failed or has been rejected, for example, because of an unacceptable revision level.

B.1.1 CPU Power Supply LEDs

CPU Power Supply LEDs			Description
Power (Green)	Predictive Fail (Yellow)	Fail (Yellow)	
Off	Off	On/Off	No AC power to this power supply
Blinking	Off	Off	AC present; standby outputs on.
On	Off	Off	Power supply outputs are OK.
Off	Off	On	Power supply failure
On	Off	Blinking	Power supply is in current-limit state.
On	Blinking	Off	Power supply is about to fail due to a poorly performing fan.

B.2 Front Panel Controls, Indicators, and Ports

Item	Control/Indicator/Port	Status
Front	Power On switch	This switch can be used to control power to the CPU and SCSI storage

Panel		enclosures whenever Windows 2000(R?) is completely shut down. Whenever Windows 2000 is starting, stopping, or running, the switch is disabled. This switch does not control power to the PCI console assembly, which is always on whenever the system is plugged into an AC source.
Front Panel	LCD	A 2-line LCD display. When the system is operating normally, constantly displays a 'spinner'. When an error occurs, displays alphanumeric messages. (Refer to "Front Panel" and to "APPENDIX ?? " for additional information on messages.)
Front Panel	USB A (?) or icon (?)	Connector jack for a USB device (for example, a keyboard).
Front Panel	USB B (?) or icon (?)	Connector jack for a USB device (for example, a keyboard) cable plug.
Front Panel	VGA (?) or icon (?)	Connector jack for a monitor cable.
Front Panel	Serial (?) or icon (?)	Reserved for use by Stratus for troubleshooting purposes.
CD-ROM drive	Eject button	Depress to extend the CD tray.
CD-ROM drive	LED (green)	Lights when the CD-ROM drive is being accessed.
High-capacity floppy drive	Eject button	Depress to eject the floppy disk.
High-capacity floppy drive	LED (green)	Lights during a read or write operation to the disk drive.

B.3 Clock Card

B.3.1 Clock Card LEDs

Status LEDs		Description
Red LED	Bi-color LED	
Off	Off	No power. The clock card has lost power and cannot light any LEDs.
On	Green	Testing/not-configured. The clock card is being tested or has not yet been configured by the operating system. Temporary condition.
On	Yellow	Dumping/testing. Contents of the clock card are being dumped to retrieve information or the clock card is being tested. Temporary condition.
Off	Yellow	Simplex mode. The clock card is fully functional but is running without a partner clock card.
Off	Green	Duplex/standby mode. The clock card is fully functional and running with a partner clock card.
On	Off	Rejected/broken. The clock card has failed or has been rejected, for example, because of an unacceptable revision level.

B.3.2 Clock LED

Clock LED	Description
On	Clock failure (oscillator is not running)

B.4 I/O enclosure

Red LED	Bi-color LED	Description
Off	Off	Slot is empty.
On	Green	The I/O enclosure or the PCI card in the slot above the LEDs is being tested or is being prepared for service. When testing completes successfully, the I/O enclosure or card begins duplex or simplex operation. When testing is not successful, the I/O enclosure or card is broken and goes offline.
On	Yellow	A dump is occurring. When the dump completes, the I/O enclosure or card begins duplex or simplex operation, or the I/O enclosure or card is broken and goes offline.
Off	Yellow	The I/O enclosure or the PCI card in the slot above the LEDs is running simplex. To change to duplex operation, issue the appropriate command and/or insert a partner I/O enclosure or card.
Off	Green	The I/O enclosure or the PCI card in the slot above the LEDs is present, inserted properly, and running normally (typically, duplexed).
On	Off	The I/O enclosure or the PCI card in the slot above the LEDs is broken or offline though it is present and is inserted properly. You need to bring the I/O enclosure or card back online or replace it.

B.5 PCI Console Power Supply

LEDs			Description
Power (Green)	Predictive Fail (Yellow)	Fail (Yellow)	
Off	Off	On/Off	No AC power to this power supply
Blinking	Off	Off	AC present; standby outputs on.
On	Off	Off	Power supply outputs are OK.
Off	Off	On	Power supply failure
On	Off	Blinking	Power supply is in current-limit state.
On	Blinking	Off	Power supply is about to fail due to a poorly performing fan.

B.6 SCSI Storage Enclosure

B.6.1 Front

Bus Mode (Green LED)	Enclosure Fault (Yellow LED)	Description
On	Off	Split bus configuration
Off	Off	Joined bus configuration
Off	On	Fault within the storage enclosure
Power On LED (Green)		Lights when power is applied to the storage enclosure.
Key lock		Mechanically locks the drives to prevent their removal from the storage enclosure.
Disk Recognition (Green LED)		Lights when the disk drive is present.

Disk Activity (Green LED)	Lights when the disk drive mechanism is active.
Disk Fault (Yellow LED)	Lights when a fault is detected in the disk drive.

B.6.2 Rear

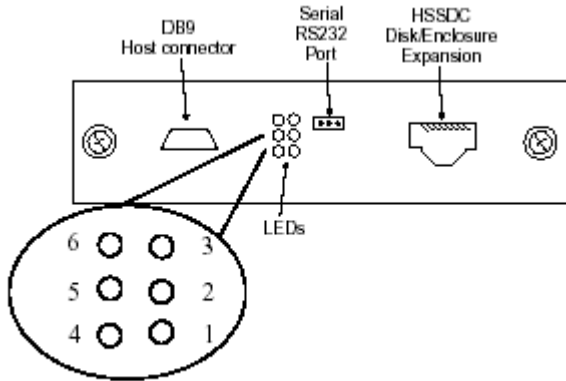
Component	Description
Configuration Switches	Configuration switches on both the ESM and the I/O module select the operating configuration. These switches are factory preset and must not be changed.
Green LED	????
Audible Alarm	This function is disabled.†
Audible Alarm Mute Switch	Used to silence the audible alarm.†
Fan Speed Error	Lights when the fan is not Operating at the proper speed.
Power On/Off Switch	Controls the application of primary power to the power supply (1 = On, 0 = Off)
Power On (Green LED)	Lights when the power supply is operating normally.
Power Fault (Yellow LED)	Lights when a fault is detected in the power supply.

† The audible alarm is disabled by ftServer software. However, if the alarm should somehow become activated, it can be silenced using the Audible Alarm Mute switch.

B.7 Fibre Channel Storage Enclosure

B.7.1 RAID Controller

There six LEDs located on the RAID Controller. The following figure shows the locations.



The LEDs are numbered and defined as follows:

	Description	Color	Indication
LED 1	Controller Not Ready	Amber	ON indicates controller is not ready.
LED 2	Controller Ready	Green	Normally ON indicates that the controller has successfully booted.
LED 3	FC Host port active	Green	ON indicates activity on the FC host port. OFF indicated no activity on the FC host port.
	Controller Partner		ON indicates that the partner controller has been

LED 4	Failed	Amber	detected as failed.
LED 5	Cache Dirty	Amber	ON indicates whether controller cache memory is flushed.
LED 6	FC Device Port(s)	Green	ON indicates activity on either of the FC device ports. OFF indicates no activity on the FC device ports.

B.7.2 LSM

There are six LEDs located on each of the front mounted LSMs.

The LEDs are numbered 0-5 from top to bottom and defined as follows:

	Description	Color	Indication
LED 0	Power On	Green	Normally ON , indicates power is applied. OFF indicates no power.
LED 1	Shelf Fault	Amber	Normally OFF indicates no faults exist in the enclosure. ON indicates a fault.
LED 2	FC Loop A	Green	ON indicates FC Loop A closed. OFF indicates FC Loop A open
LED 3	FC Loop B	Green	ON indicates FC Loop B closed. OFF indicates FC Loop B open.
LED 4	LS Fault	Amber	Normally OFF indicating that the LS Module has no fault. ON indicates an LS Module fault.
LED 5	2GB Operation ^d	Green	ON indicates the FC loop is operating at 2GB/Sec speed. OFF indicates the FC Loop is operating at 1GB/Sec Speed.

B.7.3 Disk Drive

Each disk drive carrier has two LED indicators visible from the front of the Fibre Channel storage enclosure. The green disk drive ready LED (top left) is controlled by the disk drive, and the bicolor (amber/green) LED (top right) is controlled by the LSM. The following table shows how to interpret these LEDs.

Drive Ready Green LED	Bicolor LED Green	Bicolor LED Amber	Condition
Drive Controlled	Off	Off	Slot empty, ready for insert
Drive Controlled	On	Off	Drive online, ready for operation

Drive Controlled	On 125 msec Off 125 msec	Off Off	Drive identify/Special POD identify
Drive Controlled	On 250 msec Off 250 msec	Off Off	Prepare for removal
Drive Controlled	On 500 msec Off 125 msec	Off Off	Drive rebuild
Drive Controlled	Off	On 125 msec Off 125 msec	Drive fail (enclosure fault amber LED is on)
Drive Controlled	Off Off	On 125 msec Off 750 msec	Drive Offline Loop A or Loop B (enclosure fault amber LED is on)
Drive Controlled	On 500 msec Off 500 msec Off 1000 msec	Off 500 msec On 500 msec Off 1000 msec	Predicted failure (enclosure fault amber LED is on)

B.7.4 Power Supply

The power supply has two LED indicators on it, which are visible from the rear of the enclosure. The green Power OK LED is on when the power supply is operating normally. This green LED is driven by the power supply, and indicates that the power supply output voltages are operating normally. The power supply amber Fault LED is driven by the LSM and power supply. This amber LED is ON when the LSM detects a power supply fault, or it will flash, when the power supply Locate feature is selected.

B.7.5 Advanced Cooling Module (ACM)

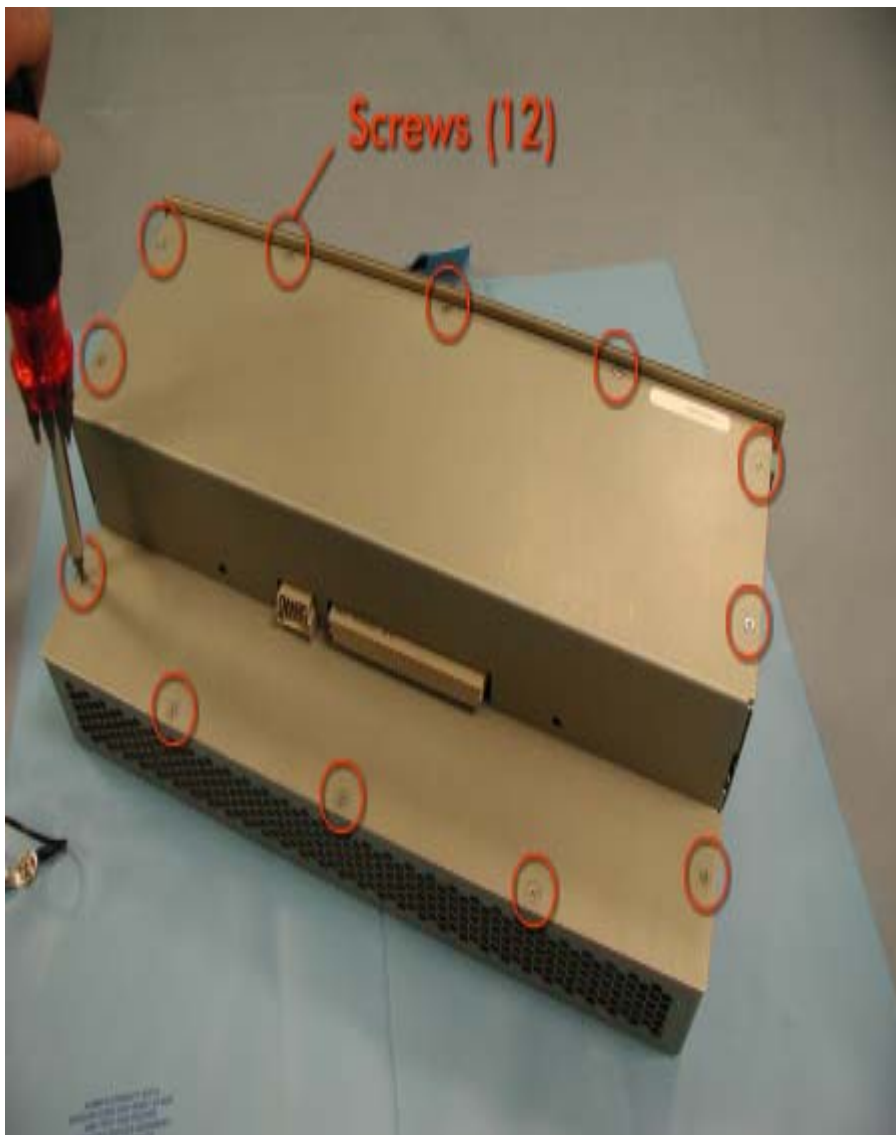
Each of the two ACMs on the rear of the enclosure has two fault LEDs visible from the rear of the enclosure. The LEDs are labeled "1" and "2" to correspond with the the two fans inside the ACM assembly. These LEDs are normally off and will only be on when a fault is detected in a fan by the LSM.

Appendix C. Installing the Shelves for the Monitor, Keyboard, and Mouse

To install the shelves for the monitor, keyboard, and mouse perform the following procedure:

1. At the front of the cabinet, count up two holes from the top of the SCSI storage enclosure on each **outside** vertical rail and install a clip nut as shown in Figure C-1.
2. Count up six more holes and install a clip nut on each **outside** vertical rail.
3. Count up 11 holes from the top of the SCSI storage enclosure on each **inside** vertical rail and install a clip nut.

Figure C-1. Front Vertical Rail Clip Nuts



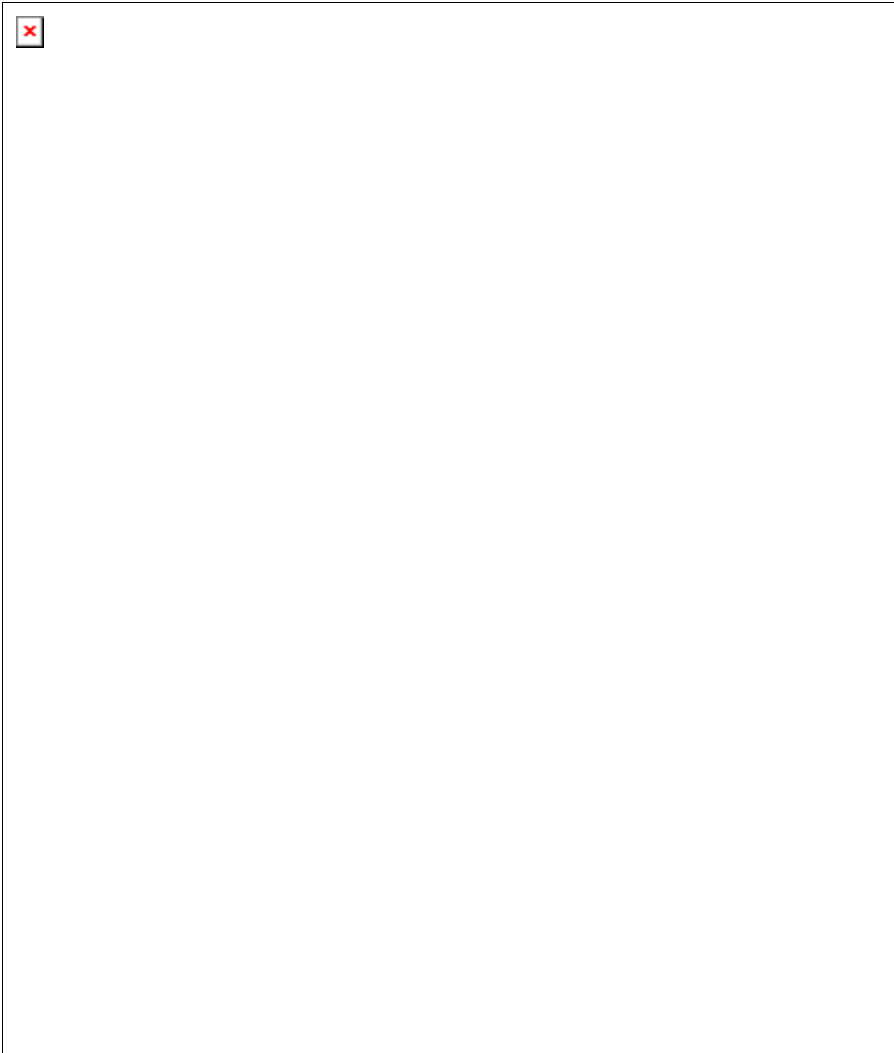
4. At the rear of the cabinet, count up three holes from the top screw in the SCSI storage enclosure rail on each outside vertical rail and install a clip nut as shown in Figure C-2.
5. Count up six more holes and install a clip nut on each outside vertical rail.

Figure C-2. Rear Vertical Rail Clip Nuts



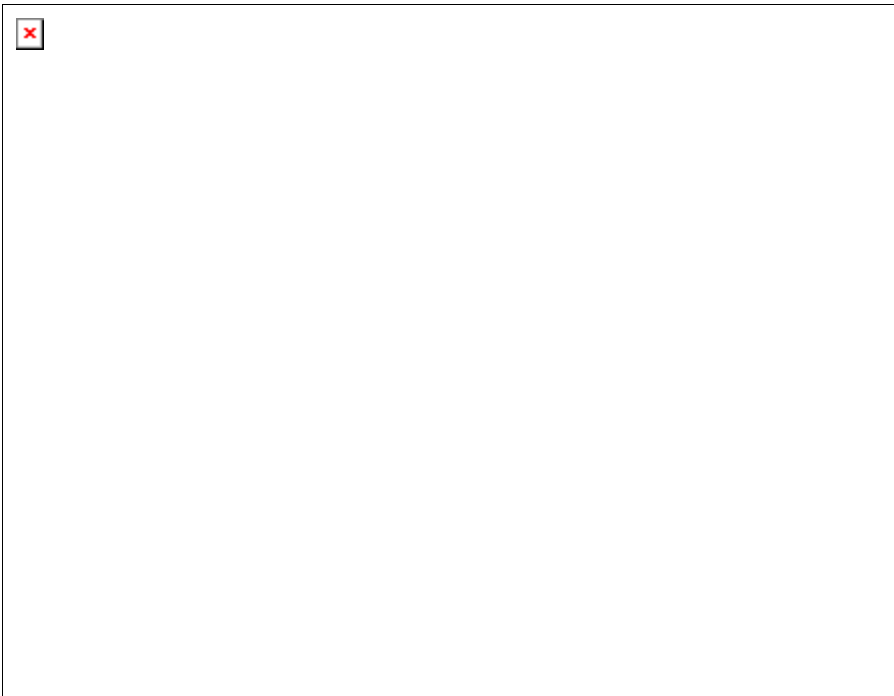
6. Install the rear brackets on each outside rear vertical rail as shown in Figure C-3.

Figure C-3. Rear Bracket



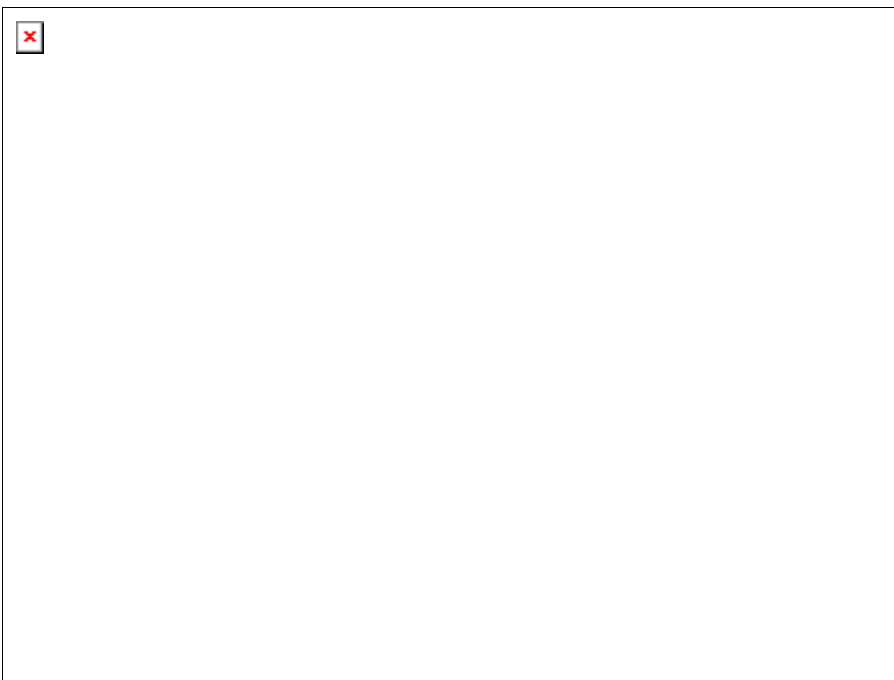
7. At the front of the cabinet, align the keyboard shelf and slide it into the cabinet until the bottom pins pointing in on the rear brackets fit into the channels cut into the back of the keyboard shelf as shown in Figure C-4.

Figure C-4. Keyboard Shelf Channel (Rear)



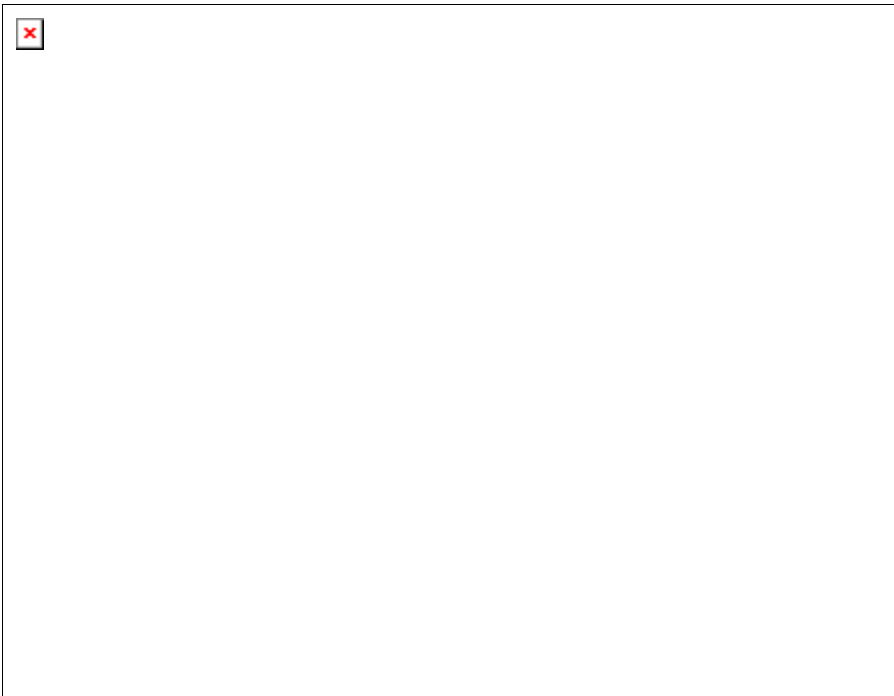
8. Align the holes in the front of the keyboard shelf with the clip nuts and install a screw on each side as shown in Figure C-5.

Figure C-5. Keyboard Shelf Screw (Front)



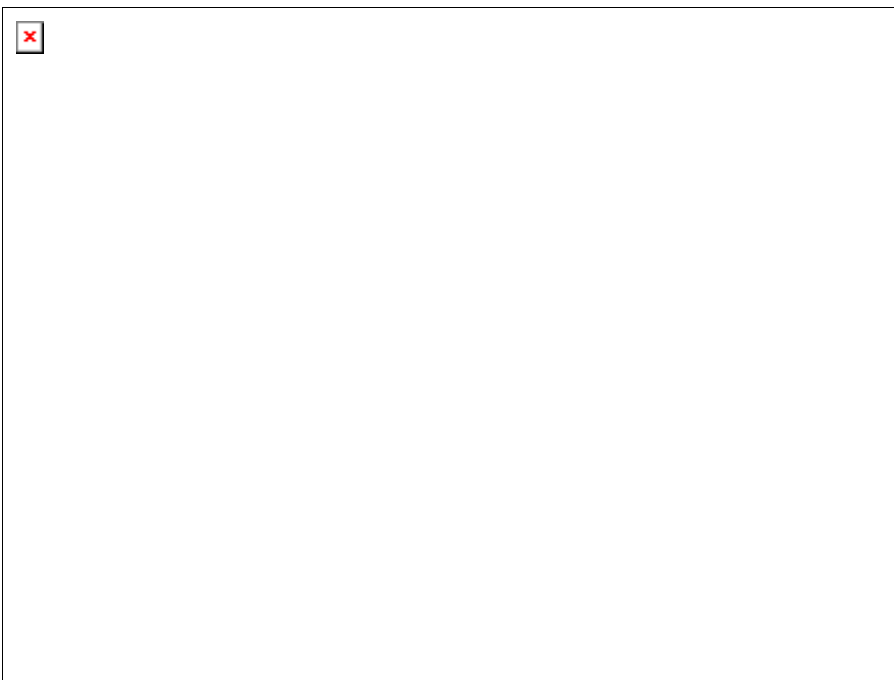
9. At the front of the cabinet, align the monitor shelf and slide it into the cabinet until the top pins pointing in on the rear brackets fit into the channels cut into the back of the monitor shelf as shown in Figure C-6.

Figure C-6. Monitor Shelf Channel (Rear)



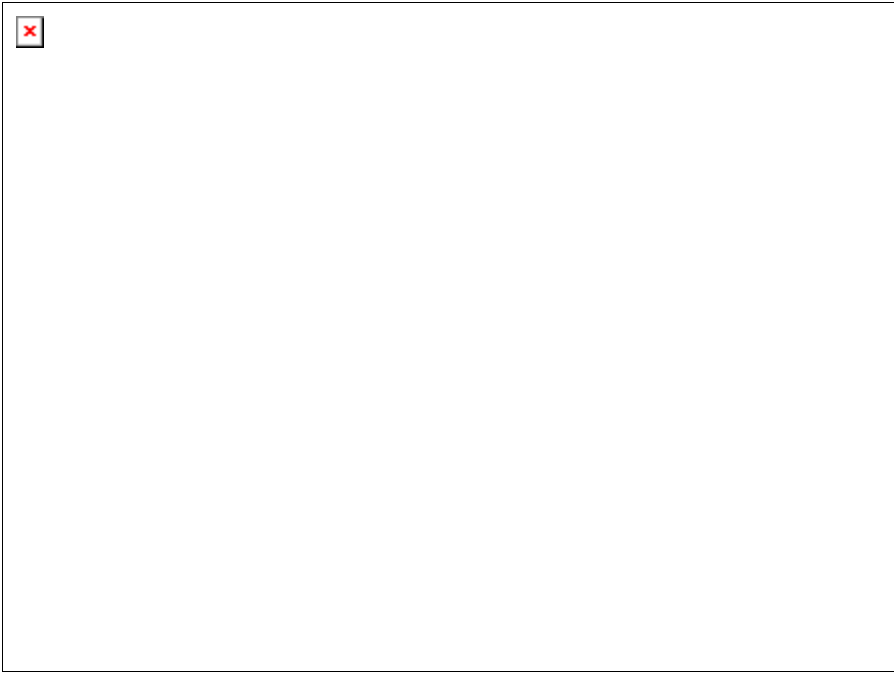
10. Align the holes in the front of the monitor shelf with the clip nuts and install a screw on each side as shown in Figure C-7.

Figure C-7. Monitor Shelf Screw (Front)



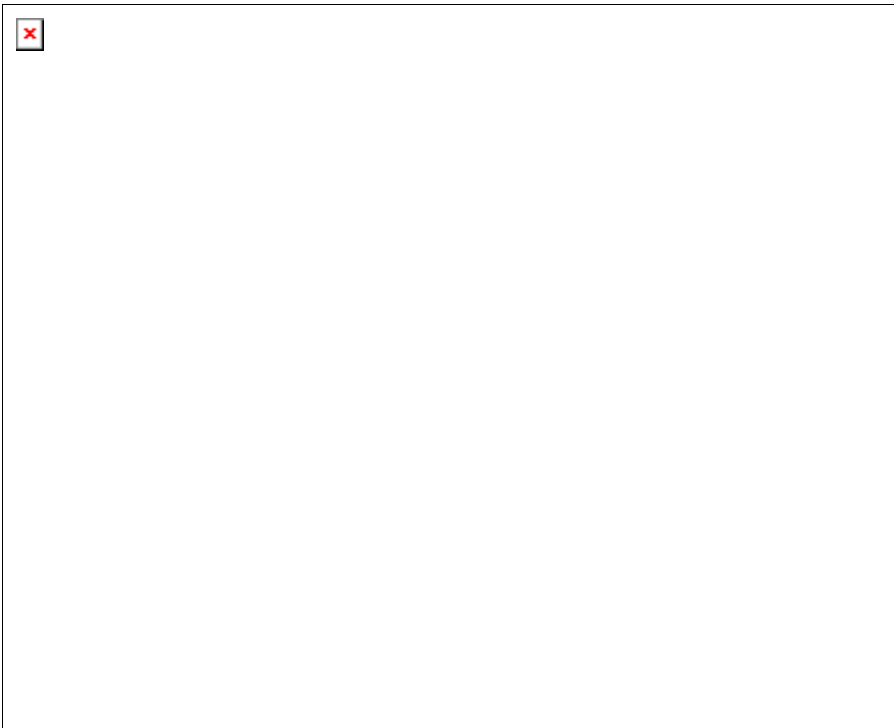
11. At the front of the cabinet, install the lower brackets for the monitor bezel in the clip nuts on each inside vertical rail as shown in Figure C-8.

Figure C-8. Lower Bracket for Monitor Bezel



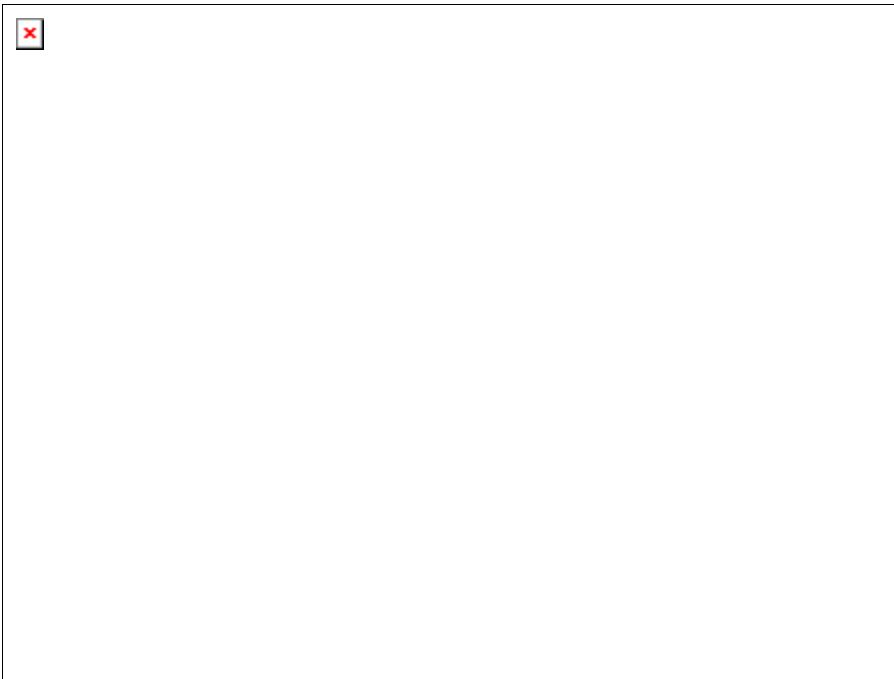
12. At the front of the cabinet, count up 26 holes from the lower brackets and install clip nuts and the upper brackets for the monitor bezel on each inside vertical rail as shown in Figure C-9.

Figure C-9. Upper Bracket for Monitor Bezel



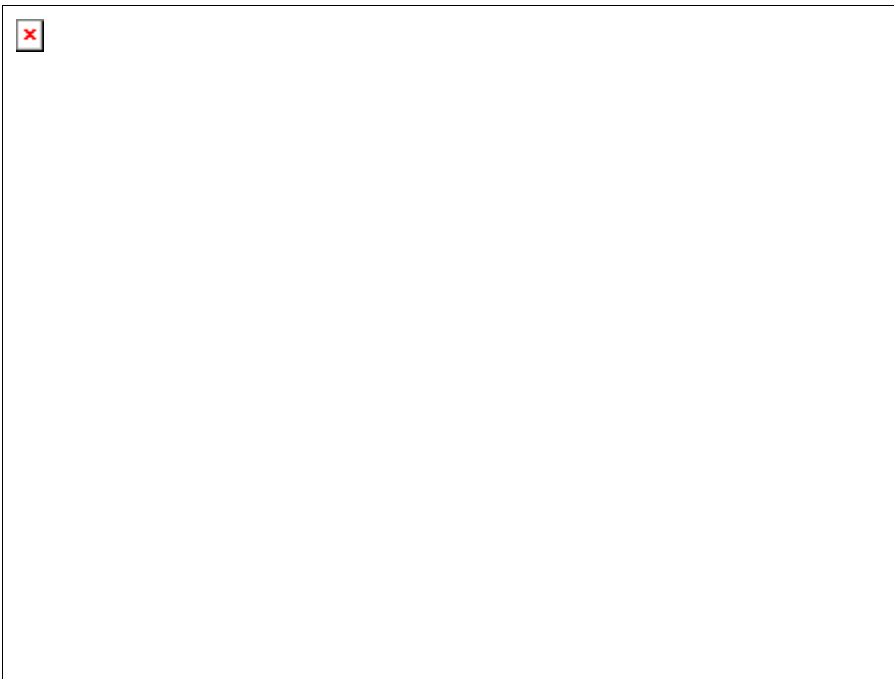
13. At the front of the cabinet, install the monitor bezel over the monitor shelf and secure it with four screws as shown in Figure C-10.

Figure C-10. Monitor Bezel Installation



14. Install the keyboard and mouse on the keyboard shelf and route the cables as shown in Figure C-11.

Figure C-11. Keyboard/Mouse Installation



15. Connect the keyboard cable to the USB connector on the front panel.(Figure C-12.)

Figure C-12.Keyboard Cable Connection

