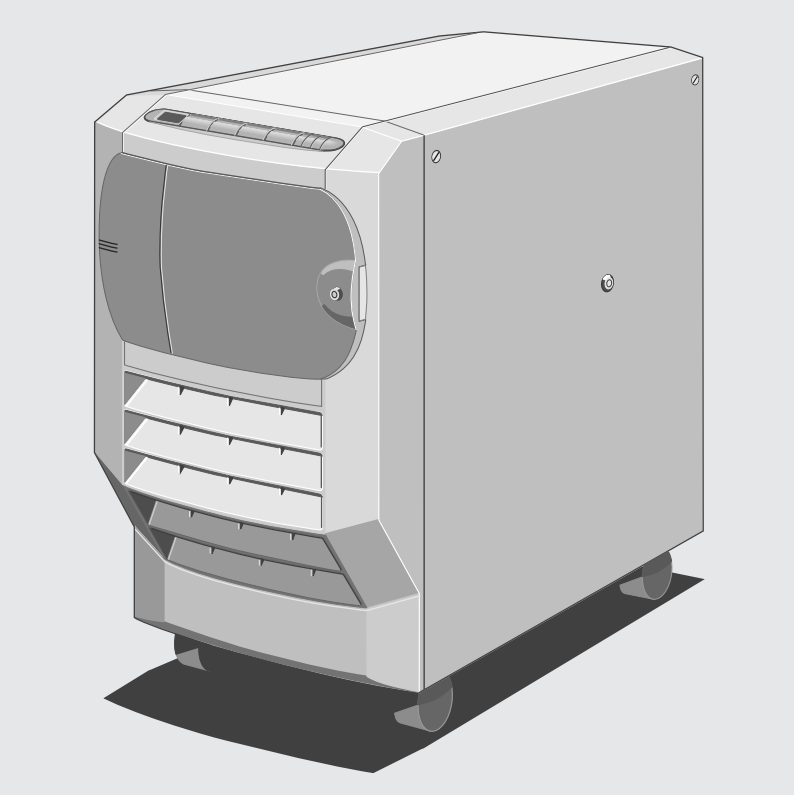
MITSUBISHI ELECTRIC

apricot

FT4200

Owner's Handbook



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PENTIUM® PRO PROCESSOR

BSI REGISTERED FIRM
NATIONAL ACCREDITATION OF CERTIFICATION BODIES

APRICOT FT4200
OWNER'S HANDBOOK

Published by:
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Birmingham Business Park
Birmingham, England
B37 7YS

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SAFETY AND REGULATORY NOTICES

Power

The computer uses a safety ground and must be earthed. The system unit AC power supply cable is its 'disconnect device'. Ensure that the system unit is positioned close to the AC power outlet, and that the plug is easily accessible.

The power supply within the FT4200 server automatically sets itself to the appropriate voltage, there is no voltage selector switch. It is advisable to avoid subjecting the power supply to voltages outside the range 85-253V AC, 47-63 Hz.

To prevent fire and electric shock, do not expose any part of the computer to rain or moisture.

Shut down the operation of the computer as described in the Owner's Handbook. Isolate any battery back up unit and unplug the power supply cable before moving the system unit, cleaning the computer or removing the side panels. An exception to this is removing the side panels before hot-plugging a hard disk drive.

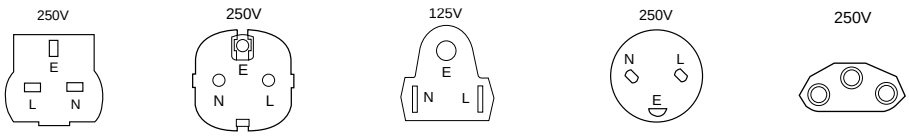
Power cord requirements

The AC power supply cable packed with the computer complies with the safety standards applicable in the country in which it is first sold. Use only this power supply cable. Do not substitute a power supply cable from any other equipment.

If you wish to use the computer in another country, you must ensure that you use an AC power supply cable and AC plug which complies with the safety standards of that country.

The power supply cable fittings should bear the certification mark of the agency responsible for evaluation within the country of use. Refer to your authorised supplier if you ever need additional or alternative power supply cables.

Typical AC plugs



BS1363A	SHUCO	NEMA 5-15P	SRAF 1962/DB16/87	ASE 1011
U. K.	Austria Belgium	Taiwan	Denmark	Switzerland
	Finland France	Thailand		
	Italy Germany	Japan		
	Sweden Norway	USA		
	Holland	Canada		

Additional Power Cord information - UK ONLY

This equipment is supplied with an AC power lead that has a moulded, non-removable, 3-pin AC plug.

Always replace the fuse with one of the same type and rating which is BSI or ASTA approved to BS1362.

Always refit the fuse cover, never use the plug with the fuse cover omitted.

Laser

Any fitted CD-ROM drive contains a laser system which is harmful to the eyes, and is classified as a CLASS 1 LASER PRODUCT according to IEC825 Radiation Safety of Laser Products (Equipment Classification: Requirements & User's Guide).

The CLASS 1 LASER PRODUCT warning label, bearing similar information to the sample above and in high visibility colours, is located on the CD-ROM unit and on the inside of the front door.

Do not attempt to disassemble the CD-ROM drive; if a fault occurs, call an authorised maintainer. Use the CD-ROM drive only as described in this manual. Failure to do so may result in exposure to hazardous radiation.

Ergonomic

When positioning the system unit, monitor and keyboard, take into account any local or national regulations relating to ergonomic requirements.

Batteries

Small batteries

This product contains a replaceable lithium battery. Do not use a metal or other conductive implement to remove the battery. If a short-circuit is accidentally made between its positive and negative terminals, it may cause the battery to explode.

Replace a discharged battery with one of the same type. Another type may explode or ignite. Dispose of a discharged battery promptly and in accordance with the manufacturer's instructions.

The battery's average life is between 3 and 5 years. Do not recharge, disassemble or incinerate. Keep away from children. If in any doubt, contact your supplier or an authorised maintainer.

Battery Backup Unit (optional)

The power supply can be equipped with a replaceable Battery Backup Unit (BBU). It will provide electric power for your system for a specific period of time, depending on how many hard disks or other devices are installed.

The battery pack contains lead acid batteries. In the EEC the directive 91/157/EEC (plus subsequent amendment 93/86/EEC) designates batteries containing lead to be handled as a dangerous substance. Similar regulations will apply in other countries.

As a result, the battery pack must only be removed by a qualified electrician and must not be disposed of in domestic waste.

Thermalcote bonding compound

The thermal bonding compound used between the system processor and its heatsink can cause skin irritation and stain clothing. Avoid prolonged or repeated contact with skin. Wash thoroughly with soap and water after handling. Avoid contact with eyes and inhalation of fumes. Do not ingest.

Standards

Safety

This product complies with the European safety standard EN60950 plus amendments 1, 2, 3 and all European country deviations.

Electro-magnetic Compatibility (EMC)

This product complies with the following European EMC standards:

Emissions	EN55022	Class B
Immunity	EN50082	Level 2

German Acoustic Noise Regulation

Sound power level is less than 70 dB(A) according to DIN 45635 Part 19 (ISO 7779).

Notes

All interconnecting cables and communication cables should be less than 2 metres in length. If cable extensions are used, ensure adequate earth connections are provided and screened cables are used.

Legalities

This equipment complies with the following European Directives:

Low Voltage Directive	**73/23/EEC**
EMC Directive	**89/336/EEC**
CE Marking Directive	**93/68/EEC**

and where applicable:

Telecommunications Directive	**91/263/EEC**

Caution

This system complies with the CE marking directive and its strict legal requirements. Use only Apricot tested and approved parts. Failure to do so may result in invalidating both the compliance and your warranty. All expansion cards or upgrade components must carry CE marking.

POWER CONNECTION INFORMATION

Note

Any ancillary equipment using an AC power supply cable should be earthed.

The power supply within the FT4200 server automatically sets itself to the appropriate voltage, there is no voltage selector switch. It is advisable to avoid subjecting the power supply to voltages outside the ranges 100-120V AC and 220-240V AC, (50/60 Hz).

The AC power supply cable packed with the computer complies with the safety standards applicable in the country in which it is first sold. Use only this power supply cable. Do not substitute a power supply cable from any other equipment.

- Before connecting up any parts of the system, ensure that the AC supply is switched off or disconnected.
- First connect up the keyboard, mouse, monitor signal cable, and any other signal cables as appropriate.
- Connect up **all** AC cables. (System to supply, monitor to supply, all related peripherals.) Then switch on or connect the AC supply.
- Switch on the monitor first, then the computer followed by the peripherals, such as printer and modem.

CONTENTS

Section One — Chapter / page

This section explains the setting up of your system and using the Front Panel Controls. There is information about back panel functions and ports, security aspects and the EISA Configuration Utility. This section also gives you details about how to install additional processors, memory and expansion cards.

Setup and Operation

Upgrading and Expansion

Section Two — Chapter / page

This section contains detailed information for an authorised engineer, with all the procedures to follow if a fault develops within the system.

Preliminary Service Information

Hard disk drives and modules

Front panels and drives

SMC

INDEX OF ILLUSTRATIONS

This table is continued overleaf

1 SETUP AND OPERATION

This section identifies the different parts of your system, explains what you should do when using the system for the first time and shows you how to carry out tasks which are part of normal operation.

Front View

The following illustration shows a front view of the server with the front drive bay door open:

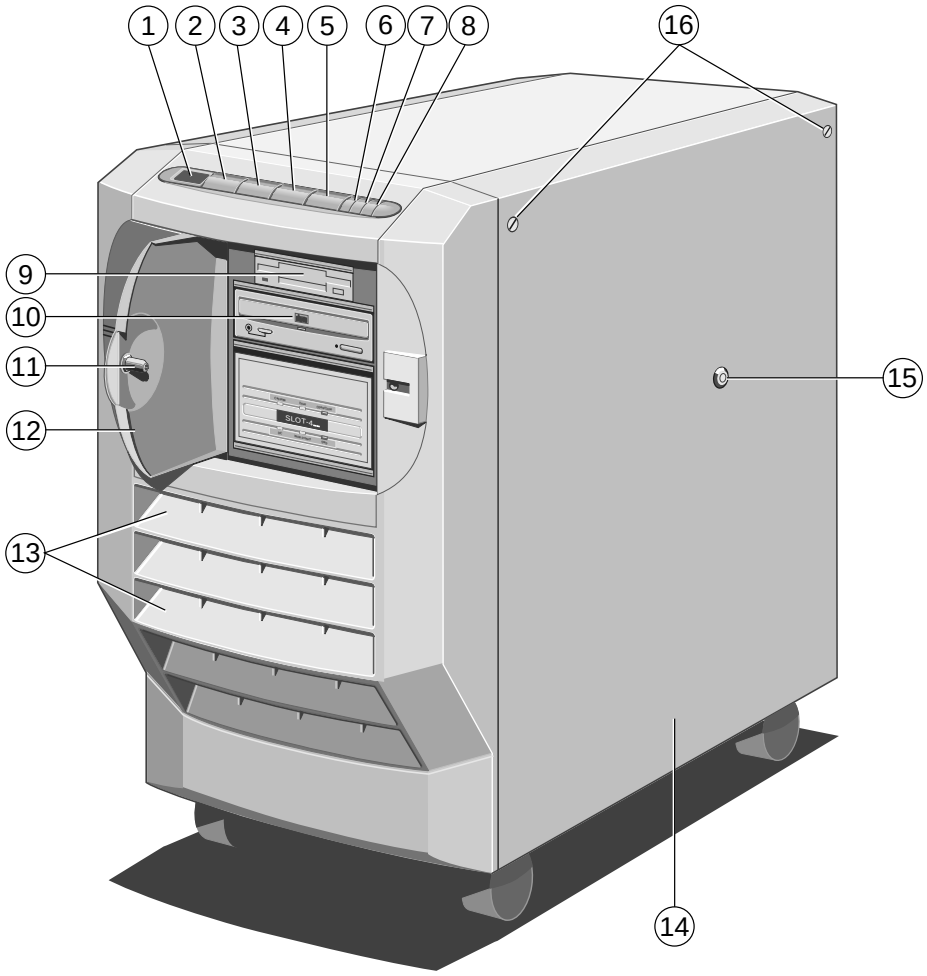


Figure 1-1 Front View

1	Diagnostic Codes LCD	9	3.5” Floppy Drive
2	POWER ON Button	10	5.25” CD ROM Drive
3	CONTROL Button	11	Drive Bay Door Keylock
4	STANDBY Button	12	Drive Bay Door
5	RESET Button	13	Air Intake Vents
6	Infrared Sensor	14	Removable Side Panel
7	UPS LED (When battery fitted)	15	Side Panel Keylock
8	Power LED	16	Side Panel Floating Fasteners

The following paragraphs give a brief explanation each item on the front of the machine:

- **Diagnostic Codes LCD** - Displays diagnostic codes that indicate errors or normal stages in the boot process (see the chapter *Diagnostic Codes*).

- **POWER ON button** - Pressing this button switches the machine from Standby mode to On mode.

- **STANDBY button** - Holding this button down powers down the server from On mode to Standby mode. This button also has special functions in conjunction with other buttons (see *Special Button Functions* later in this chapter).

- **CONTROL button** - Pressing this button silences alarms which sound because of internal errors. It also has special functions in conjunction with other buttons (see "Special Button Functions" later in this chapter).

- **RESET button** - Performs a hard reboot of the system. This button also has special functions in conjunction with other buttons (see "Special Button Functions" later in this chapter).

- **POWER LED** - Indicates whether the server is On or is in Standby mode.

- **UPS LED** - Indicates whether the system is receiving power from the optional battery back up unit or from the mains electricity supply. It also indicates the status of the battery.

- **Lockable drive bay door** - Provides security against unauthorised access to the removable media drives. The key to this door serves as the token used to control the built-in security subsystem (see "Security" later in this chapter).

- **Air Intake Vents** - Openings in the front bezel through which the system draws air in order to prevent overheating. These must not be blocked or restricted in any way.

- **Removable Side Panel** - Provides protection for the internal components and security against unauthorised access to the interior of the server.

Greater detail of the controls and their use is given in the following pages of this chapter, along with important information on connecting and setting up your system.

Note

The system power supply consists of load sharing, plug-in modules that can be hot-swapped. The very basic configuration is one module and there can be a maximum of four. Each module can contribute 267W to the system power requirements (see chapter 10 for further information). When contemplating expansion, upgrades, or increasing the number of hard drives consult your Apricot supplier as regards to your computer's new power requirements.

Rear Panel

The rear panel contains the various ports and connectors as shown in the following illustration:

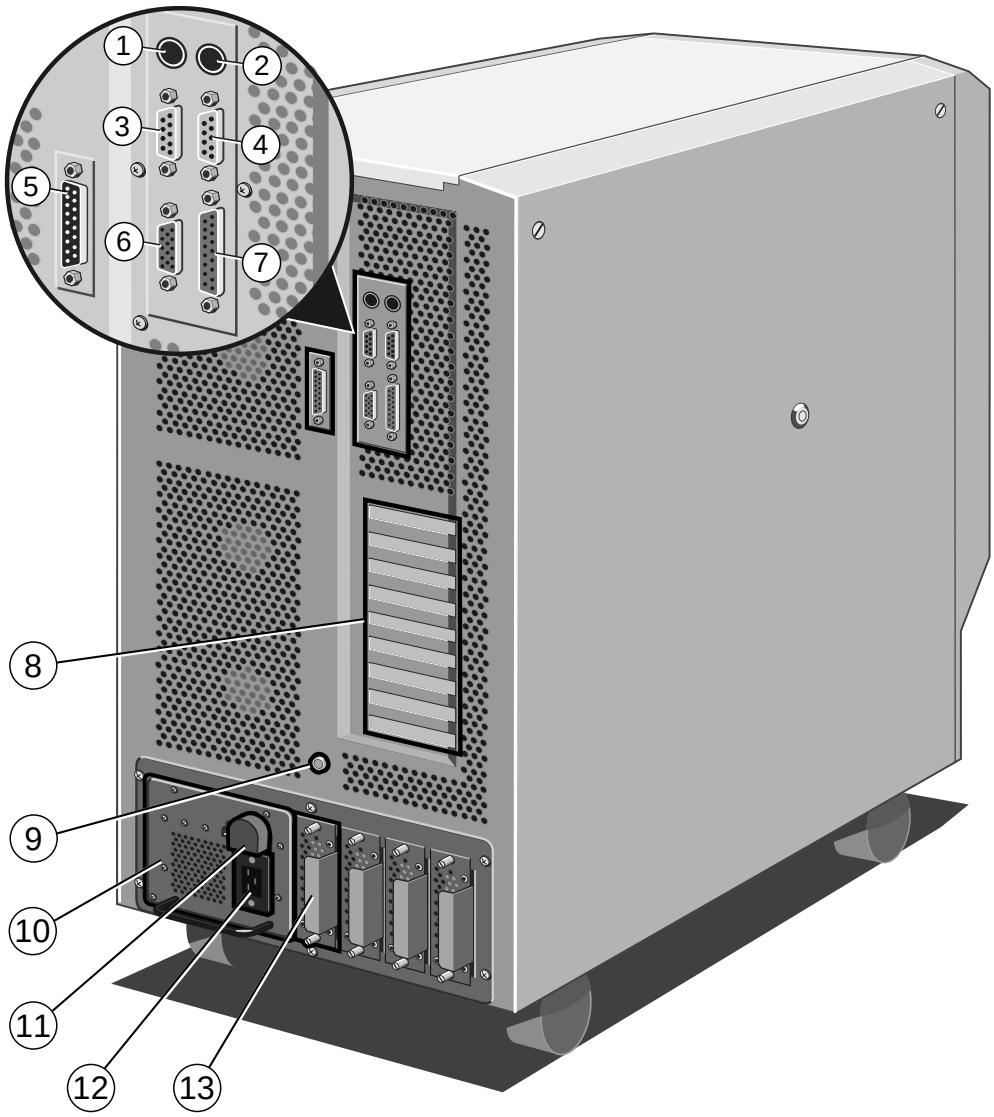


Figure 1-2 Rear Panel

1	Keyboard Connector (PS/2)	8	Expansion Slot Openings
2	Mouse Connector (PS/2)	9	Stud for Antistatic Strap
3	Serial Port COM2	10	Optional Battery back up unit
4	Serial Port COM1	11	Battery isolation link
5	SMC Modem Port	12	AC Power Socket
6	Video Connector	13	Power Supply modules
7	Parallel Port		

Machine Interior

The interior of the server consists of the following main areas:

- Hard Disk Subsystem
- Removable Media Drive Bay
- Motherboard
- Systems Management Controller Board
- Power Supply Modules and optional Battery Back Up unit
- Cooling Fans

To gain access to the interior of the machine, you must remove the side panels. Chapter 2, *Upgrading and expanding*, contains side panel removal instructions.

Hard Disk Subsystem

The hard disk subsystem is the area in which the hard disks are located. It occupies the lower portion of the disk drive chamber. It can be configured to accommodate up to 20 hard disk drives. For full details refer to the chapter on hard drives in the service section of this handbook.

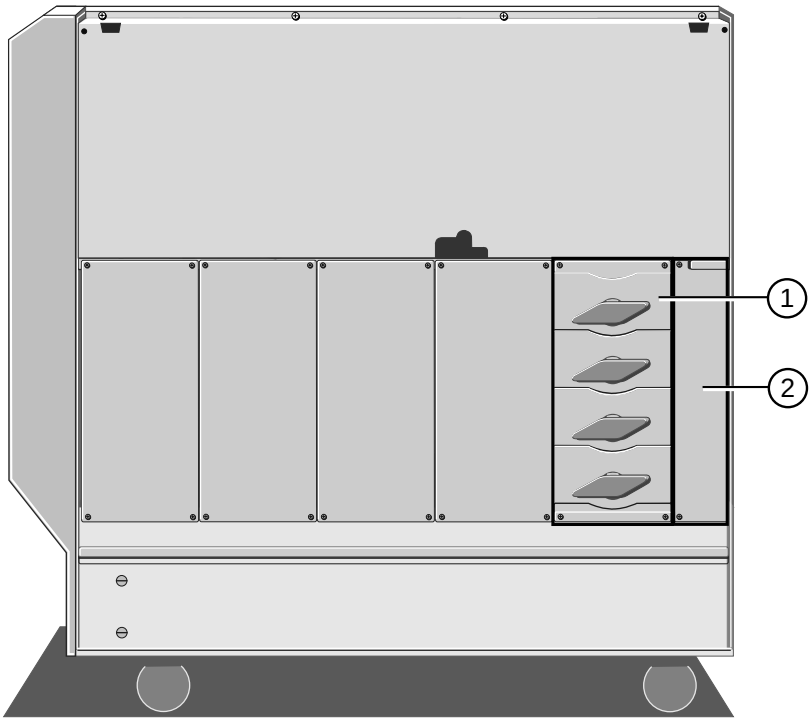


Figure 1-3 View of hard disk subsystem

1	Disk Subsystem	2	Cooling Fan Assembly

Note

Fitting aditional hard disk drives and drive modules may require extra Power Supply modules, especially if another upgrade or expansion is being conducted at the same time. Consult your Apricot supplier. As a general guideline, each Power Supply module can supply up to 267W to the computer (see chapter 10 for further information on System Power).

Removable Media Drive Bay

The removable media drive bay is the area which can contain drives such as floppy, CD ROM and tape backup drives. The bay will accommodate up to four half-height drives. Your system will contain at least one 1.44-Mbyte floppy disk drive.

User access to the drive bay is through the lockable drive bay door on the front bezel. The lock on the door is fitted with a sensor which, when security is enabled, sounds an alarm if the door is opened without using the key to unlock it, i.e. if it is forced.

Motherboard

The motherboard contains the various disk controllers and other electronics necessary to control the server's functions. It contains the memory and first two processors as well as PCI and EISA expansion slots.

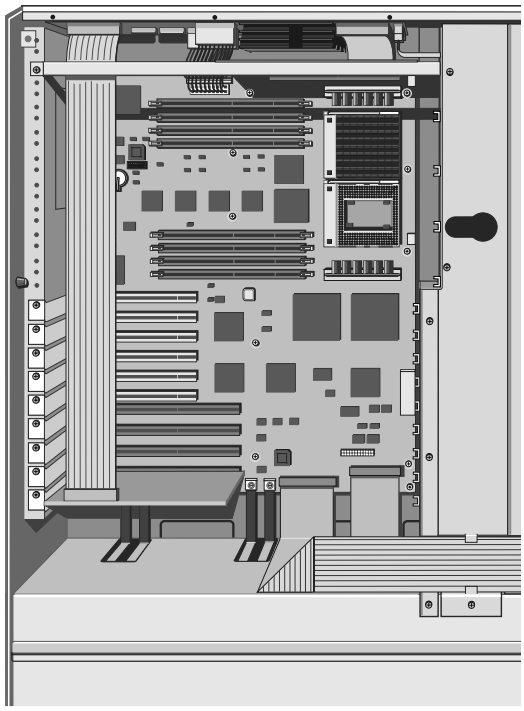


Figure 1-4 Motherboard in the Electronics chamber

Power Supply and optional Battery Back Up unit (BBU)

The power supply itself can consist of the minimum of one plug-in module or the maximum of four. Each module can provide up to 267W to the computer's power requirements (see chapter 10 for further information). If there is more than one Power Module, the computer may be able to continue to operate if one module should fail, depending upon the configuration. When considering any additions to the computer hardware, the power requirements should be assessed prior to their installation.

When the BBU is fitted, the complete power supply becomes an uninterruptible power supply (UPS) and is designed to keep your system powered up for a limited period of time after, or during, a power failure. The optional on-line removable BBU will provide time to shutdown the network and the server without losing valuable data.

The UPS should maintain power to the system for approximately 4 minutes in a fully-laden system, i.e. equipped with 20 hard disk drives. This time will be much longer in a system equipped with fewer drives.

Note

In the event that the mains power fails, the LCD will display a countdown of the number of seconds remaining until the (optional) battery back up unit is fully discharged. The ***Event Manager User's Guide*** *contains more details about this feature.*

Cooling Fans

Your computer is equipped with six thermally controlled and alarmed cooling fans, three on each side of the machine. These will prevent overheating by maintaining an appropriate temperature inside the system.

In addition there are two cooling fans within the power tray unit.

Caution

You must maintain at least 15 cm space around the computer for adequate ventilation. Otherwise damage could result from overheating.

Setting Up Your System for the First Time

After you have unpacked the server and rolled it into position, use the jacking mechanism on the front castors to immobilise it (as shown on the Quick Start Guide). Then go through the following steps to start up the system:

- Connect the monitor signal, keyboard and AC power cables to the sockets on the server's back panel.
  - ◊ See the guide supplied with the monitor for details on its connections to an AC supply and general information about its signal cable.
- Establish the appropriate link which will enable you to run the System Management Application (SMA), such as:
  - ◊ Direct link to another PC. In this case, use the supplied serial-to-PC cable to connect the SMC modem port to the serial port on the separate diagnostic computer.
  - ◊ Modem link to a computer at another location. Use the supplied serial-to-modem cable to connect the SMC port to the modem.
  - ◊ In some cases you can also run the SMA over the network itself, from one of the connected computers, depending on the operating system.
- Switch the AC supply on, followed by (if a battery is fitted) plugging in the BBU isolation link on the rear of the system.
  - ◊ The UPS LED should display steady green (BBU fully charged) or flash green (BBU is charging). If the LED is flashing, it will take a maximum of 36 hours to charge the batteries from full discharge.
  - ◊ The system is now in Standby mode.
- Locate and press the POWER ON button to switch the machine on.

When the system is up and running normally following boot-up and all software loaded, the display code on the front LCD panel will be **0000.** If any codes appear other than normal procedure codes, then refer to the chapter dealing with diagnostic codes towards the end of this handbook. Some codes are transitory, being way markers for the boot-up process.

Before proceeding further, read carefully the following pages in this chapter. They contain important information about the controls and their functions.

Using the Front Panel

This section describes the functions of the front panel during normal operation.

Caution

Do not place any large or heavy objects on the top, especially near to the front facia. Likewise avoid leaning on the machine. It may inadvertently cause the operation of one or more front panel buttons.

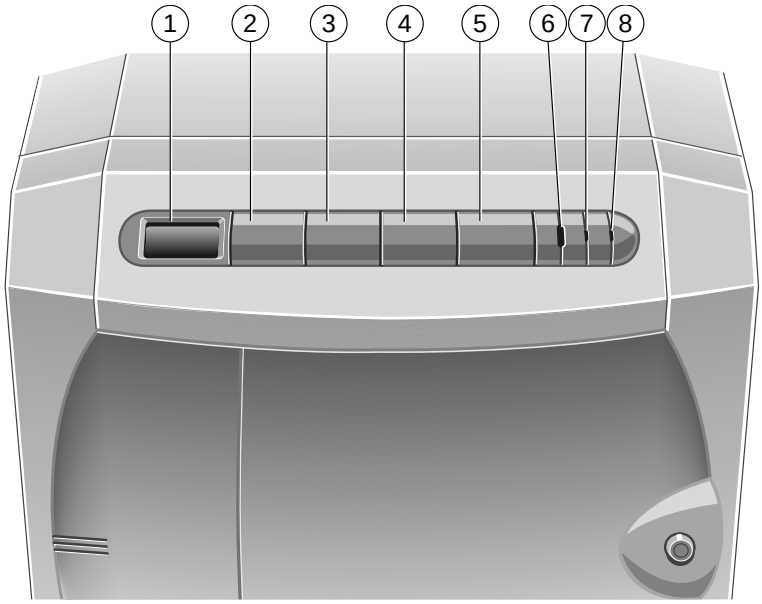


Figure 1-5 Front Panel Controls

1	Diagnostic LCD	5	Reset Button
2	Power On Button	6	Infrared Sensor
3	Control Button	7	UPS LED
4	Standby Button	8	Power LED

Power On

Press this button to switch the system on from Standby mode. The Power LED will light up and the system will initiate its boot sequence. Diagnostic codes, expressed as hexadecimal numbers, will appear as a matter of course on the LCD screen on the Front Panel (see the chapter *Diagnostic Codes Reference* for details). The screen will display the SCSI ID number for each of the SCSI devices installed in your system. What happens after this depends on how your Apricot has been configured, i.e. which operating system or other software may be installed. Check with your supplier if you need more details.

Control

Press this button to silence alarms and clear LCD display codes that are produced because of internal errors and power failures (but not security alarms).

Pressing CONTROL at the end of firmware initialisation forces the System Management Controller (SMC) to execute the code of the EPROM instead of the Flash ROM, even if the version in the Flash is newer than that of the EPROM. This allows you to boot from EPROM if there is something wrong with the Flash code.

Note

It is good practice to warn anyone who may be accessing the system remotely, i.e. using the SMA from a remote computer via the modem port, before you press the STANDBY button.

Standby

After you have instructed all network users to close their applications down and log off the network, hold this button down for a specific period of time before the system initiates a shutdown sequence to Standby mode. The system will display the code **1200** on the LCD and sound a tone. Continue to hold down the STANDBY button until the tone stops, at which time the shutdown sequence begins. In Standby mode, the mains electricity supply keeps any BBU fully charged, but there is no DC power supplied to the system. Use the System Management Application (SMA) to specify, in seconds, how long you must hold down the button before the shutdown sequence begins (see the SMA User's Guide). The default is 3 seconds.

- Press STANDBY and CONTROL simultaneously to cancel the current Standby sequence. (Only if last client is loaded)

Note

When accepted, the Standby timer requests that the operating system be shutdown, thus the final screen message will be "Shutdown or Restart OS." If Restart is selected the motherboard is reset and the POST sequence initiated. During this period the SMC timer is still running and can move the system into Standby at any point. ***To prevent possible data loss or corruption it is recommended to always select Shutdown in this situation.***

Reset

Press this button to initiate a hardware reset, but only if it is absolutely necessary. The LCD will display **1400**. You must hold the button down until the accompanying tone stops sounding. Use the System Management Application (SMA) to specify how long, in seconds, the reset tone will sound (see the *SMA User's Guide*). The default is 3 seconds.

- Press RESET and CONTROL simultaneously to cancel the current reset sequence. (Only if last client is loaded)

Special Button Functions

Caution

Do not use these functions unless there is serious problem with the system and it is absolutely necessary.

Pressing STANDBY, CONTROL and RESET simultaneously while the front drive bay door is **unlocked** switches the system into a mode in which these three buttons have special functions. The LCD displays 8888 to indicate this mode. The following paragraphs describe the special function of each button.

- STANDBY or RESET - Pressing **either** of these buttons initiates a memory dump to the central processing unit by activating and then deactivating the Non-Maskable Interrupt (NMI) signal via the diagnostic processor. The effect of this action will depend on the operating system. You can then use the appropriate function of the network operating system to examine the contents of the dump.
- CONTROL - Pressing this button initialises the modem, which is connected to the SMC modem port on the back panel of the server. If the modem initialisation is successful, the LCD displays the code 0000. If the initialisation is unsuccessful, the LCD displays 0F4D or 0F4E.

- STANDBY + RESET - Pressing these buttons simultaneously clears the LCD and then releasing them executes an independent SMC reset. This would only be necessary if a major problem or error had occurred in the system, which is unlikely.

If you do not press any buttons for ten seconds, the system returns to normal mode.

UPS and Power LEDs

The UPS and Power LEDs indicate the state of the system as follows:

UPS LED

- When this LED shows steady green, it indicates that the system is powered by mains electricity and the optional BBU is fully charged.
- Flashing green indicates that the system is powered by mains electricity and the optional BBU is in the process of charging. This will usually be the case after the system has been without mains electricity, i.e. disconnecting the plug or a power failure.
- Steady amber indicates that the system is drawing its power off the optional BBU, i.e. there is no mains electricity. As soon as mains electricity fails, an alarm sounds.
- Flashing amber indicates that the optional BBU is about to fail.
- Off shows that any BBU is disconnected either because the BBU link on the back of the machine has been pulled out, or the system is disconnected from the mains.

Power LED

- Steady green indicates that the system is on and powered.

Security

Your Apricot is equipped with a security system to help prevent unauthorised persons tampering with the front panel buttons and gaining access to the interior of the system.

Security is enabled within the System Management Application (see the *SMA User's Guide*, the *Event Manager User's Guide* or the on-line help within the SMA software). Once security is enabled, the key to the removable drive bay door at the front of the machine serves as the security token:

- If the door is closed and has been locked with the key, the screen is blanked, the keyboard is disabled, the security alarm is activated and will sound if there is a violation.
- Unlocking the door unblanks the screen, enables the keyboard and deactivates the security alarm.

Note

When security is enabled and the door locked, you can use the KeyLOC infrared card to unblank the screen and enable the keyboard temporarily. The card will also silence a security alarm. Use the card again to blank the screen and disable the keyboard.

The following actions are security violations and will set off the alarm when the drive bay door is closed and locked and security is enabled:

- Forcible opening (i.e. without the key) of the removable drive bay door.
- Removal, with or without the key, of one or both of the side panels.

- Pressing the STANDBY, CONTROL or RESET buttons individually or in any combination.

To silence the alarm, use the key to unlock the drive bay door. If the door is already unlocked when the alarm sounds, first lock and then unlock the door. Alternatively, use the KeyLOC card to silence the alarm.

Automatic Failure Recovery

As with any computer system, your server may develop a hardware or software fault, which, for example, may only manifest itself intermittently, that causes the system to hang. If this happens, the server is capable of resetting itself automatically. This is particularly useful if the server is unattended some or all of the time.

Whether the server is able to rebuild the complete network environment, together with application programs, after an automatic reset depends on the operating system. The SMA contains several variables which govern the behaviour of automatic failure recovery:

- Machine Status
- Watchdog Timeout
- Watchdog Timer Reboot Count
- Watchdog Timer Timeout Action

You can make settings for these variables to enable, disable or modify their effects. The on-line Help system within the SMA contains details of all of these variables and how to make the appropriate settings.

Using the EISA Configuration Utility (ECU)

The ECU automates the configuration process for your computer's hardware and the boards (ISA, EISA, Plug-n-Play and PCI) or options that you add to the system. You must run the ECU each time you change your computer's configuration. The ECU does the following:

- Maintains system parameters and stores these in non-volatile RAM.
- Presents the option settings that specify those parameters.
- Assigns all necessary system resources, to eliminate conflicts.
- Presents settings for other functions, such as date and time.

Note

You should use only the ECU to configure your system, as other setup utilities may not be accessible via a remote computer or over a network.

To run the ECU

- Locally, press F2 to run the Flash Disk Utility during the hardware boot sequence but before the operating system loads, remotely, run the Flash Disk Utility via the SMA.
  - ◊ You also can use the SMA to instruct the system to load the ECU automatically (see the *SMA User's Guide*). The Flash Disk Utility menu then appears on the screen.
- Select "Run Configuration Utility" from the Flash Disk Utility menu.

In a short while you will be presented with a screen similar to this:

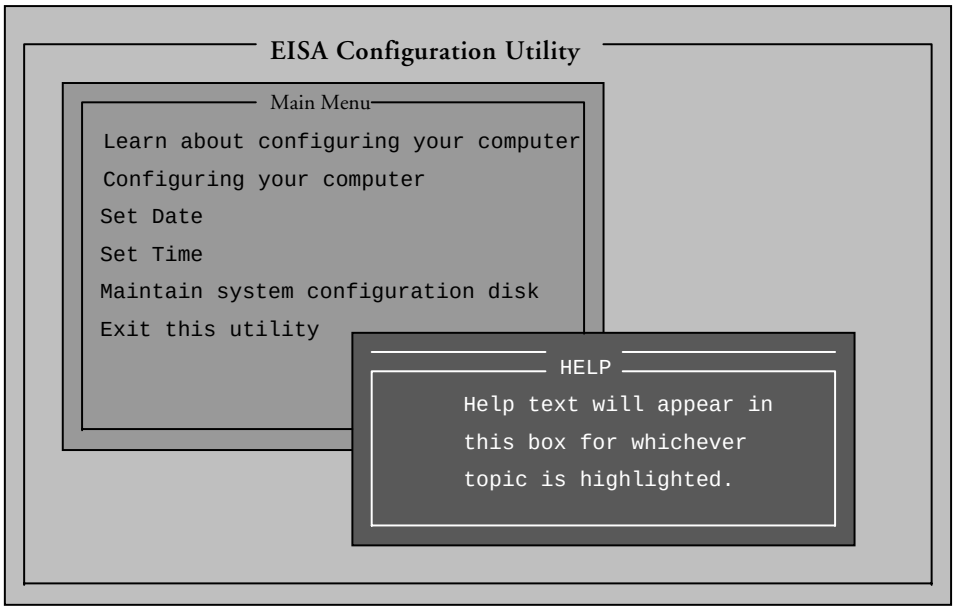


Figure 1-6 ECU opening screen

How to use the ECU

The Help text will provide most of the instructions you will need to use the ECU. The following paragraphs briefly explain the general techniques for navigating your way through the utility.

Using menus and selection screens

- To select an option from a menu or selection screen, use the UP or DOWN ARROW key to move the highlight to the option and press the ENTER key.

Note

The fact that the some of the sub-menu options are listed as numbered steps does not necessarily imply that you must select them in numerical order every time you run the ECU.

- Some screens contain vertical scroll bars on the right-hand edge, which indicate that there is more information than one screen can accommodate. You can use UP or DOWN ARROW to scroll through the information. If you need to scroll quickly through a series of screens, use PAGE UP or PAGE DOWN.
- Use the 'escape' key to return through the menu structure. If you have made any changes you will be prompted to save them first, or warned that you must save them or changes will be lost.

ECU Help

A help box is always available giving basic information on whichever menu item is currently highlighted. More detailed and useful information can be found as a simple tutorial in the first menu item, 'Learn about configuring your computer'.

Configuration

When you are ready to configure the computer, select the appropriate item on the menu. Brief messages informing you of the loading into memory of the configuration files will be displayed then you will be presented with a screen similar to this:

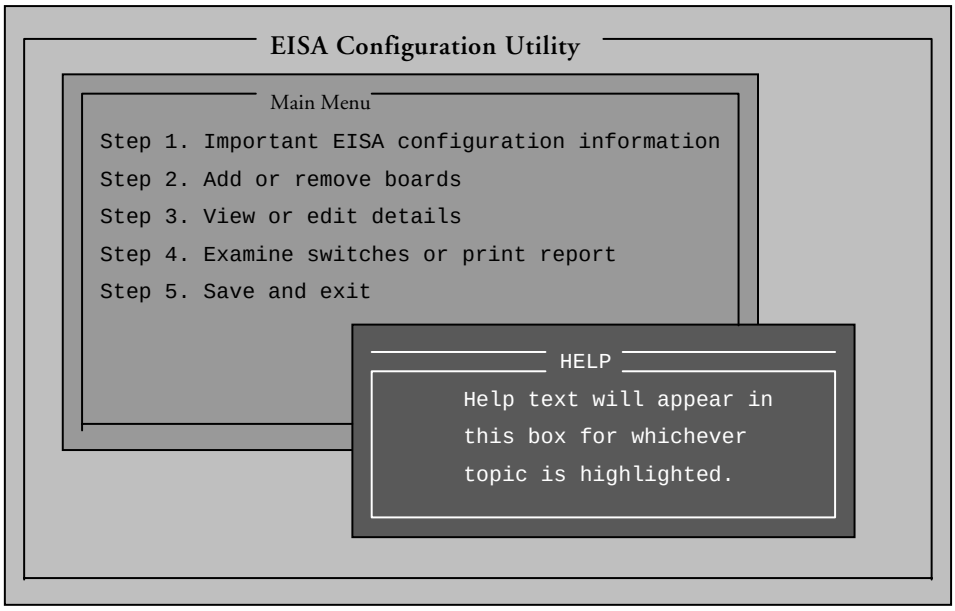


Figure 1-7 ECU Configuration screen

Additional small information boxes may appear at the bottom of some screens giving, for example, "press enter to select" or "press 'ESC' to return to main menu".

The Flash Memory

The Flash is a special portion of read-only memory (ROM). It differs from conventional ROM in that its contents can be updated, but it still preserves its information when system power is off. The following components of your server contain their own portions of Flash memory:

- The motherboard - This Flash stores the BIOS information for the motherboard.
- The System Management Controller - This Flash stores the BIOS and firmware which control the SMC and the Front Panel.
- The System Management Interface Card (SMIC) - This is the main Flash, also referred to as a Flash Disk. It contains bootable DOS, its own BIOS and a Flash Disk Utility program which affects the other portions of Flash memory. The Flash Disk Utility also runs the EISA Configuration Utility (ECU).

Your access to the Flash is via a RAMdrive. This enables you to treat the Flash almost as if it were a disk drive. The RAMdrive and the Flash Disk each have a capacity of 2 Mbytes. Because the Flash Disk contains the operating system files, the server can boot from it if the normal system hard disk boot process fails. You can also copy files to the Flash Disk, e.g. hardware component configuration (.CFG) files which the ECU uses. If you are using the RAMdrive to enter details of an add-in card, **you must remember to update the Flash disk before closing.**

The Flash Disk Utility

The RAMdrive is necessary because the Flash Disk is write-protected and therefore you cannot copy anything directly to it. The purpose of the Flash Disk Utility is to enable updates to the information held in any portion of Flash memory, such as new BIOS versions or hardware information stored in the ECU.

To run the Flash Disk Utility locally, press F2 during the hardware boot sequence but before the operating system loads. This instructs the server to boot from the Flash Disk and load the utility. The screen then displays a menu with the following options:

- **Receive File** - This option copies a file from the server to the workstation which is running the SMA. If you are not using the SMA and are running the utility locally, the file is copied from the Flash to a floppy disk. After you select 1 from the menu, select the file you want to copy and press the ENTER key.
- **Transfer File** - This option is the opposite of Receive File, i.e. it copies a file from the SMA workstation to the server or, if you are running the utility locally, from a floppy disk to the Flash.
- **Run Configuration Utility** - Select this option to run the ECU (see "Using the EISA Configuration Utility", earlier in this chapter).
- **Upgrade Motherboard BIOS** - This option enables you to upgrade the motherboard's BIOS with a new version of BIOS information. This information is in the form of a binary file. When you select this option, you have the choice of either copying the binary file to the RAMdrive and updating the BIOS in one operation or, if the correct binary file is already copied, just performing the update.
- **Upgrade SMIC BIOS** and **Upgrade SMC Firmware**, are similar to option 4.
- **Upgrade Flash Disk** - This option copies the contents of the RAMdrive to the Flash Disk, thereby making the Flash identical to the RAMdrive.

Caution

You must perform this step to copy information on add-in expansion cards back to the Flash Disk, after installing any card and making the necessary entries in the ECU on RAMdrive, All details will be lost to the system on a re-boot or reset.

- **Reset Flash Disk for Upgrade** - This option does the opposite to option 8, i.e. copies the contents of the Flash to the RAMdrive, thereby making the RAMdrive identical to the Flash.
- **Edit a File** - Use this option to load a file into the Microsoft Edit program for editing.
- **Exit** - This option exits from the Flash Disk Utility and passes control back to the SMA.

2 UPGRADING AND EXPANSION

This chapter explains the procedure for upgrading the CPU to one of higher speed and also provides information on upgrading the memory. You can also install expansion cards to increase your system's capabilities.

Your system can support up to four CPUs. They all must be of the same speed and type.

Important Note

This system has been tested to comply with CE marking and its strict legal requirements. Use only Apricot tested and approved parts. Failure to do so may result in invalidating both the compliance and your warranty. All expansion cards must carry CE marking.

Gaining Access to the Machine Interior

To gain access to the interior of the machine, you must remove the side panels. The following illustration shows the securing screws and key lock which are present on each side panel:

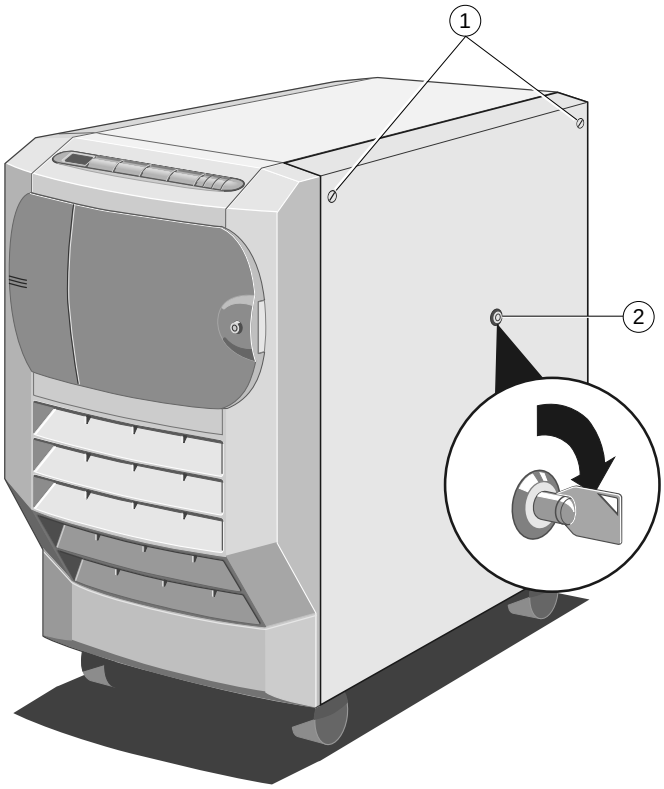


Figure 2-1 Side Panel Keylock and Floating Fasteners

1	Floating Fasteners	2	Keylock

To remove the side panel:

1. Refer to the SMA and note down the value of the *TimeOnCharge* variable. This value expresses, in seconds, the remaining charge in any fitted battery back up. Since isolating the battery pack (see below) sets the *TimeOnCharge* variable to zero, you will need to reset the variable in the SMA after you have completed the work and set the switch back to the On position.
2. Power down the system to Standby mode.

3. Ensure that any fitted battery pack is isolated. The link must be removed.
4. Disconnect the system from the AC supply.
5. Loosen the floating fasteners, located at the top left and right corners of the panel, until they move in and out freely. These fasteners are mounted in a spring fitting and should not be separated from the panel.
6. Insert the side panel key into the keylock and turn it ¼ turn clockwise to unlock the panel. Your system is equipped with one pair of side panel keys. Both keys in the pair will unlock both side panels.
7. Press the panel firmly downwards, against the springs, in order to pull it outward and then upward as shown:

Figure 2-2 Removal of side panel

Refitting the Side Panel

Use the following steps to refit the side panel:

1. Ensure that the lip on the inner surface of the side panel fits over the chassis ridge at the panel bottom edge.
2. Press the panel downwards against the springs, then fit it in under the top edge.
3. Tighten the floating fasteners.
4. Insert the side panel key into the lock and turn it clockwise as far as it will go.
5. Push the lock inward until you feel the resistance of the metalwork.
6. Turn the lock ¼ turn anti-clockwise and remove the key.
7. Use the SMA and the front door key, as appropriate, to ensure that Security is enabled.

Upgrading the CPU

Important Note

The procedures explained in this section are for authorised engineers only.

The first two CPU positions are located on the motherboard, towards the top of the electronics chamber. A second pair of processors can be located on an additional card which may be fitted at the top of the motherboard.

To gain access, it is required to remove the protective metal plate which covers the upper part of the electronics chamber. On completion of any work it is important to replace this panel for airflow integrity.

1. Remove the securing screws as shown in the following diagram:

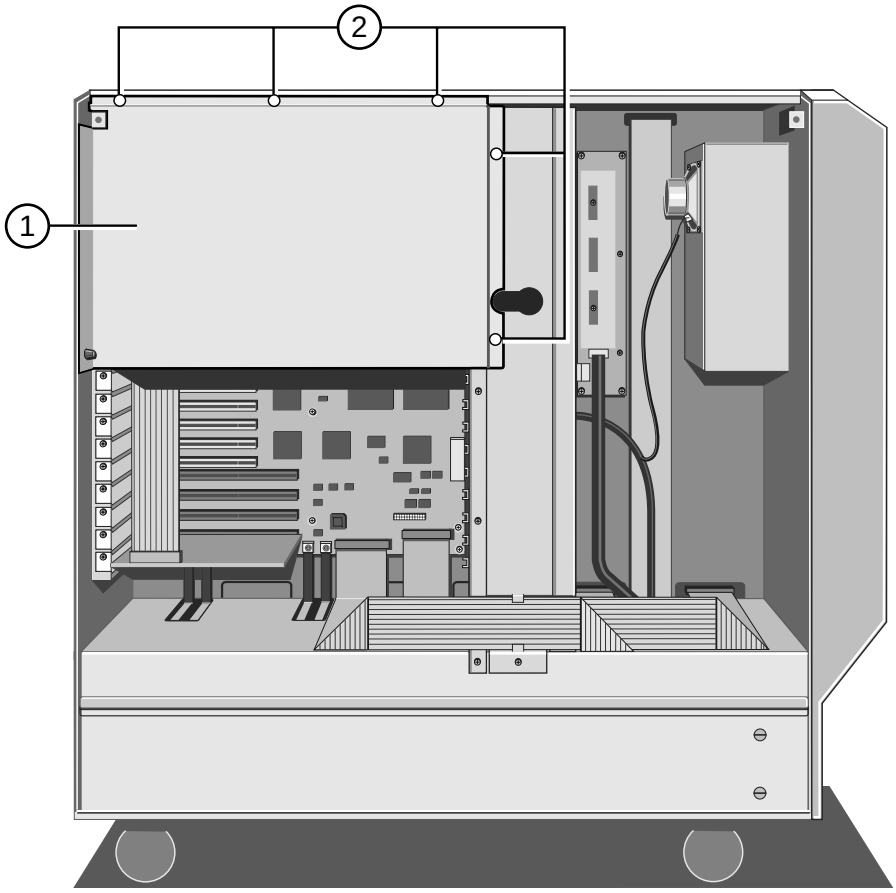


Figure 2-3 Protective Metal Plate

1	Protective Metal Plate	2	Securing Screws

2. Lift the metal plate away from the metalwork.

Caution

All electronic computer components are sensitive to static electricity. Always take antistatic precautions before handling such components (see the Appendix for more details). An earthing stud is provided at the rear of the server.

Memory and CPU locations

This diagram shows the positions of the CPUs and main memory:

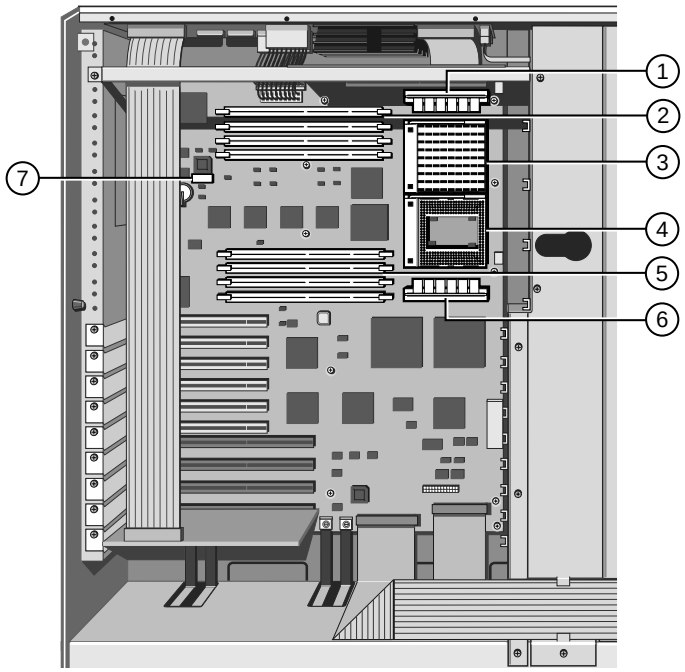


Figure 2-4 Memory, CPU and Clock switches

1	VRM for processor 'B'	5	DIMM sockets 5-8
2	DIMM sockets 1-4	6	VRM for processor 'A'
3	Processor 'B'	7	Clock and multiplier SWs
4	Processor 'A'		

To remove the existing processor

1. If the system was in use just before starting this procedure, the processor **will be hot**, wait at least 15 minutes for it to cool down.
2. If there is no processor fan, a strong spring clip secures the large heatsink to the processor. Release the end of the spring from the hook on the front of the ZIF socket with care and slide the heatsink clear. Handle carefully as there may be heat transfer compound on the heatsink face.

   ◊ There may be a power lead for a fan if the processor has one fitted in the place of a simple heatsink. Take note of the fan power lead polarity before releasing it from its board connection.

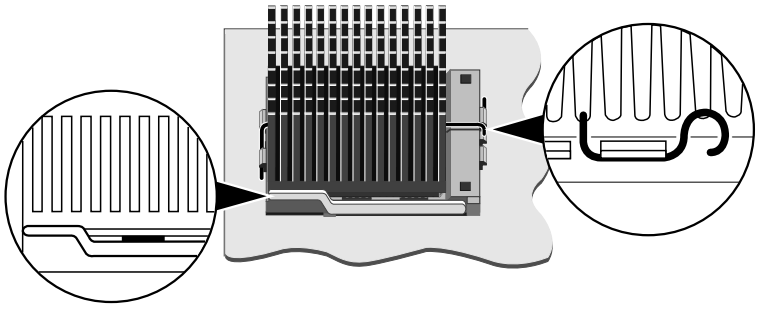


Figure 2-5 Processor and ZIF socket assembly.

3. A lever attached to the ZIF socket secures the processor in the socket. Unhook the lever from the locked position. Lift it upright (at right-angles to the motherboard). There may be a little stiffness at the beginning and end of the lever's movement.

4. Lift the processor out of the socket and place it on an anti-static surface outside the system unit. Hold the processor by its edges and *avoid touching any of the metal pins.*

Warning

If the processor does not easily lift out of, or fit into the socket, do ***not*** *force it or damage may be caused to the processor and the socket. Consult your supplier or an Apricot dealer.*

To fit the upgrade processor

Complete kits of Processor, Spring clip, Heatsink and Voltage Regulator Module (VRM8) are available from your Apricot dealer.

1. Ensure that the securing lever on the ZIF socket is still in the upright position.

Caution

If the computer has more than one CPU fitted it requires all CPUs to be upgraded. ***They must all be of the same speed and type.***

2. Take the upgrade processor out of its anti-static packaging. Hold the processor by its edges and avoid touching the metal pins. The processor and ZIF socket are designed to ensure that the processor can only install in the correct orientation. (The pin pattern is totally different at one end.) It will only fit into the socket one way.

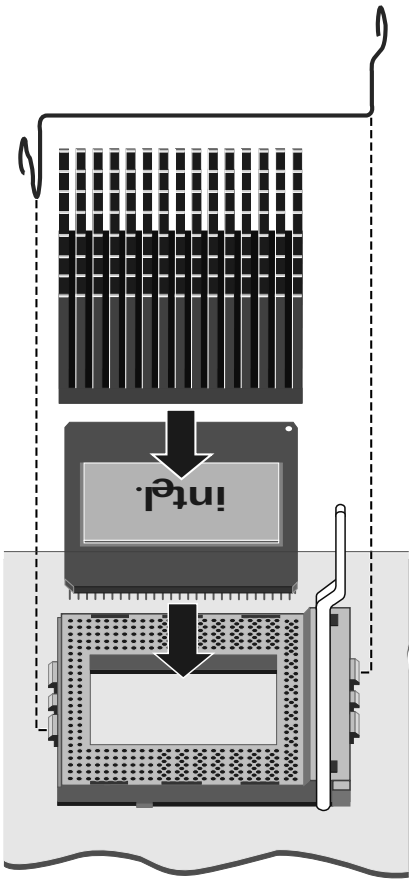


Figure 2-6 Fitting a processor

3. Place the processor in the socket, making sure that it is correctly aligned and that you do not bend or otherwise damage the pins. **Do not use excessive force**.
4. Move the ZIF socket lever to the locked position. Apply just enough pressure to overcome the resistance offered by the lever. Ensure that it is firmly locked into its down position.
5. Refit the heatsink if the new processor was supplied without one and secure correctly the retaining spring. **Ensure the heatsink is central on the processor and is securely held**.
   - ◊ If the spring is no longer required, remove it completely by disengaging it from its hook on the rear of the ZIF socket.
   - ◊ The upgrade processor may have a fan power lead to be connected to the pins on the board. The 'Overdrive' type processor however may have its own internal connection for the fan power supply.
6. It is vital when fitting an additional processor, that the Voltage Regulator Module (VRM8) is inserted into its socket/connector adjacent to the processor's ZIF socket. It will only fit one way.

Now adjust the processor multiplier and external bus clock speed switches on the motherboard (in conjunction with the new processor's data sheet), as in the following tables. Note that all other switch positions are reserved.

External bus clock			***Processor bus multiplier***				
Frequency	SW1-5	SW1-6	SW1-1	SW1-2	SW1-3	SW1-4	Factor
66Mhz	off	on	on	on	on	on	x2
60Mhz	on	off	on	off	on	on	x2.5
50Mhz	on	on	on	on	off	on	x3
			on	off	off	on	x3.5
			on	on	on	off	x4

Warning

Do not alter the processor or clock settings under normal operation unless upgrading all the fitted processors. It could result in permanent damage to either the motherboard or the processors.

Additional CPUs, 'C' and 'D'

If there are two processors fitted to the motherboard and if it is required to fit a third+fourth processor, the extra processor board will need to be fitted.

The procedure for fitting processors to this extra board is identical to that for the motherboard, but for safety and ease of assembly it is recommended to be completed before installing the card in the system, on a suitable antistatic surface or mat. The processors and VRMs ***must be exactly the same*** as the ones fitted to the motherboard. The additional processor board must be inserted in the slot at the top of the motherboard:

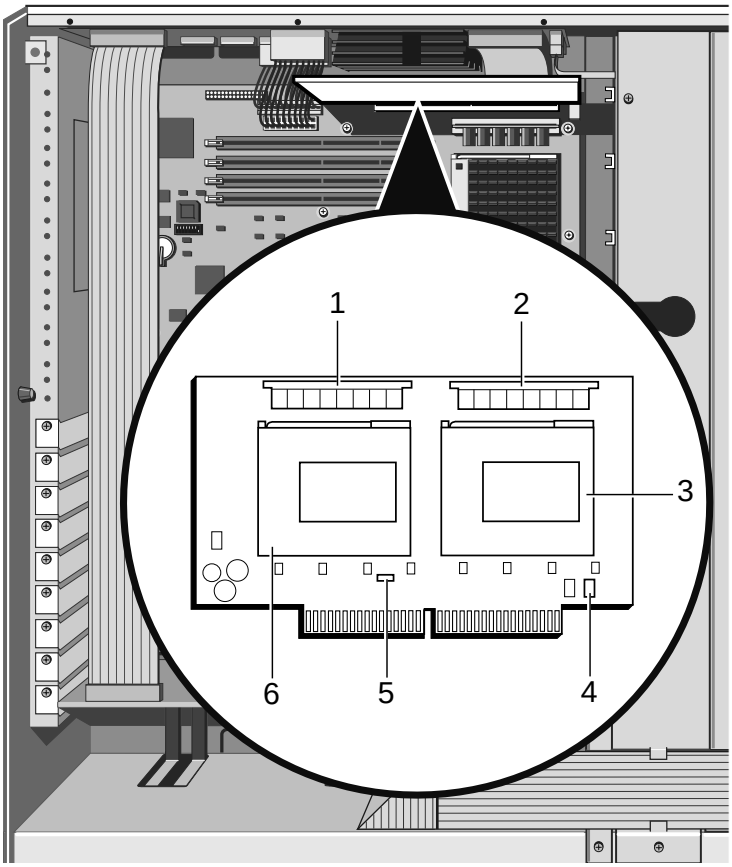


Figure 2-7 The additional CPU card

1	VRM for processor 'D'	4	Fan connection (if required)
2	VRM for processor 'C'	5	Fan connection (if required)
3	ZIF socket for processor 'C'	6	ZIF socket for processor 'D'

1. Disengage the termination board from its slot at the top of the motherboard and place it in suitable packaging.
2. The additional CPU board then fits into the same socket, with the processors facing downwards.
3. Fit the metal support strut into place. Hooks at one end fit into the fan housing and the other end is fixed with a screw at the chamber rear. Ensure that it is firmly fitted onto the edge of the CPU board.

Note

Fitting the Additional CPU card equipped with two processors may require an extra Power Supply module, especially if another upgrade or expansion is being conducted at the same time. Consult your Apricot supplier for details. As a general guideline, each Power Supply module is rated at 267W (see chapter 10 for further information).

Upgrading Memory

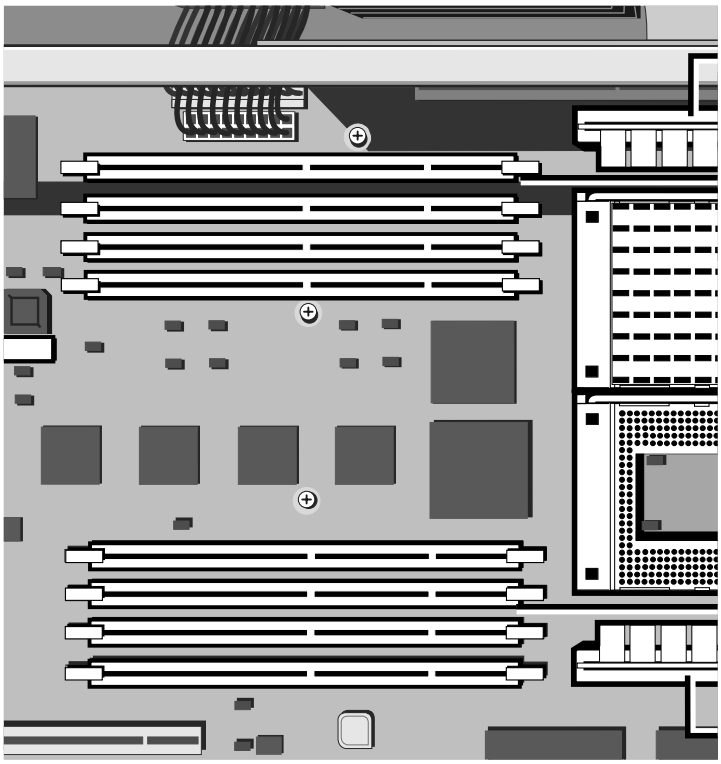


Figure 2-8 Memory DIMM sockets numbering

Caution

This system complies with the CE marking directive and its strict legal requirements. Use only Apricot tested and approved parts. Failure to do so may result in invalidating both the compliance and your warranty. All expansion cards or upgrade components must carry CE marking.

There are two banks of memory, each with sockets for four Dual Inline Memory Modules (DIMMs). Slots are numbered from 1 to 8 (top to bottom). Slots **2, 4, 6 and 8,** form bank **ONE** and slots **1, 3, 5 and 7,** form bank **TWO**. Read the following guidelines carefully before proceeding further:

- The first DIMM in the system must occupy **memory socket 2** (1st of bank ONE).
  - ◊ A second DIMM of the **same** capacity should go into **socket 4** (2nd of bank ONE).
  - ◊ If a second DIMM is of a **different** capacity it must go into **socket 1** (1st of bank TWO).
- You must fill one, two or all four slots in a bank. Three DIMMs in a bank **is not supported**. You must therefore fit 1, 2, or 4 modules. (using 2 banks = 8 DIMMs)
- All the DIMMs fitted within a bank must be the same capacity. (See the supported memory configuration table overleaf).
  - ◊ EDO and FPM type DIMMs can be mixed.
  - ◊ Bank TWO can have different capacity modules to bank ONE, but **must** have the same number of modules as bank ONE.

- ◊ Use only 3.3 volt, gold contact modules.

- All fitted modules should be the same speed.
  - ◊ 80ns, 70ns and 60ns are all supported, but 60ns may provide performance benefits with some operating systems.
  - ◊ The BIOS will adjust to the speed of the slowest module if they differ.
- The minimum configuration is one DIMM, but there are benefits in fitting 2 or 4 DIMMs, as 2 or 4 way interleave, respectively, then become available. See the following table.

Interleave scheme

Interleave	*Bank ONE*	*Bank TWO*
1 way	Socket **2**	Socket **1**
2 way	Socket **2+4**	Socket **1+3**
4 way	Socket **2+4+6+8**	Socket **1+3+5+7**

Summary of memory rules

The first DIMM in the system must go into socket TWO (1st of bank ONE) and subsequent DIMMs of the same capacity are recommended to be placed in sockets 4, 6, and 8 (bank ONE), to take advantage of the memory interleave, although they can be fitted into bank TWO if you wish to do so.

Bank TWO, when used, **must** contain the same number of DIMMs as bank ONE. They may be the same or different capacity but **must** be a configuration as listed in the table below.

Supported memory configurations

The following table lists the supported memory configurations for either of the two banks. Bank ONE socket 2 must be used first. Bank TWO, when used, *must have an identical number of modules*. They may be of different capacity but must be a supported configuration from this table (see rules on previous page).

Maximum memory, 2Gbytes, using 8 DIMMs (4 in each bank).

Total memory in a bank	*1st socket in a bank*	*2nd socket in a bank*	*3rd socket in a bank*	*4th socket in a bank*
32-Mb	16 Mb	16 Mb	—	—
32-Mb	32 Mb	—	—	—
64-Mb	16 Mb	16 Mb	16 Mb	16 Mb
64-Mb	32 Mb	32 Mb	—	—
64-Mb	64 Mb	—	—	—
128-Mb	32 Mb	32 Mb	32 Mb	32 Mb
128-Mb	64 Mb	64 Mb	—	—
128-Mb	128 Mb	—	—	—
256-Mb	64 Mb	64 Mb	64 Mb	64 Mb
256-Mb	128 Mb	128 Mb	—	—
256-Mb	256 Mb	—	—	—
512-Mb	128 Mb	128 Mb	128 Mb	128 Mb
512-Mb	256 Mb	256 Mb	—	—
1-Gb	256 Mb	256 Mb	256 Mb	256 Mb

Removing DIMMs

Caution

Before attempting to remove or fit a DIMM, be sure to take proper antistatic precautions, such as using an antistatic strap. (See the Appendix for more details on antistatic precautions). An earthing stud is provided at the rear of the server.

If you wish to install an upgrade in a bank which is already occupied you may need to first remove the existing DIMMs. For each DIMM in the bank:

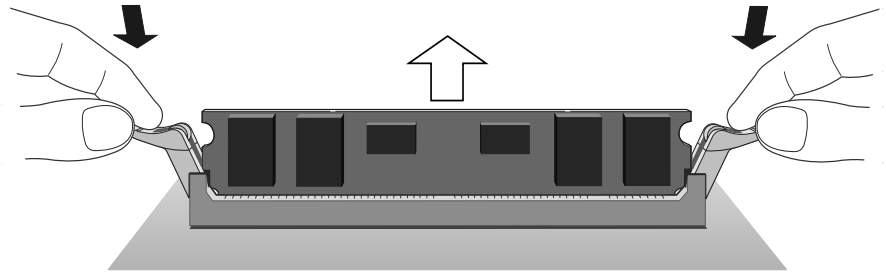


Figure 2-9 Removal of DIMMs

1. Press gently the clips on each side of the socket gently outwards using your forefingers. This will disengage the clips and lift the DIMM up and out of the socket.
2. Taking care to avoid touching any of the components on the DIMM, grip the top corners of the DIMM between thumb and first finger and carefully lift the module out of the socket.
3. Place the DIMM in a suitable antistatic package.

Inserting DIMMs

Important

Apricot Computers Ltd extensively tests many types of memory modules. DIMMs obtained from any other source cannot be guaranteed to operate correctly or safely with the rest of the system and software. Non Apricot parts may invalidate both the CE approvals and the system warranty.

For each socket in the bank:

1. The DIMM will only install in one orientation. There are indents along the DIMM's edge connector as shown:

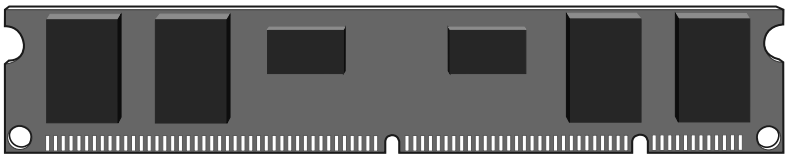


Figure 2-10 A typical DIMM

2. Hold the DIMM with its metal connector strip nearest the board surface.
3. Press the DIMM gently into the socket and ensure the end clip at each end clicks into place, retaining the module in the socket.

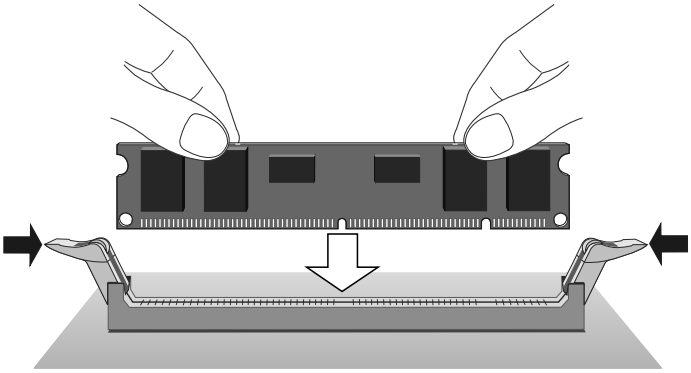


Figure 2-11 Positioning the DIMM

4. If the clips will not latch easily, remove the module and start again.

Do not use excessive force.

Installing and Removing Expansion Cards

The following illustration shows the positions of the expansion card slots in the electronics chamber:

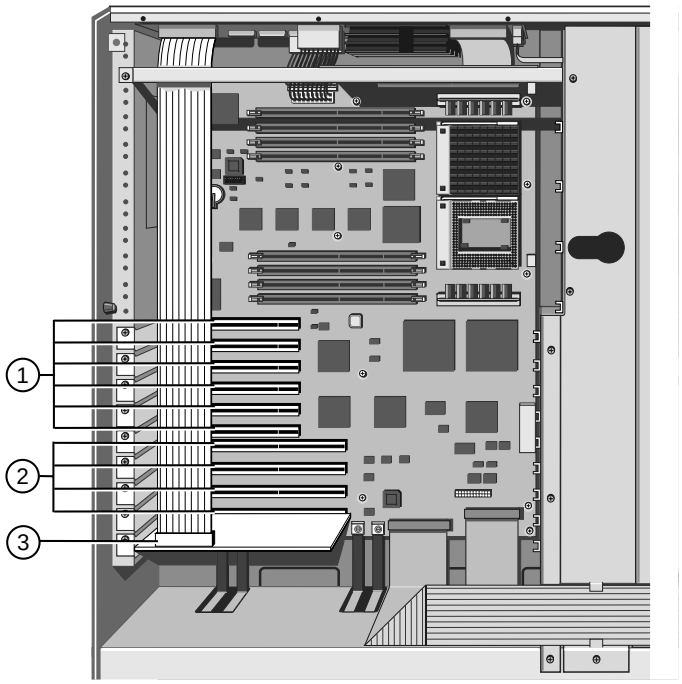


Figure 2-12 PCI and EISA/ISA Expansion Card Slots

1	PCI Slots	3	SMIC card (bottom slot)
2	EISA/ISA Slots		

Important

You must always replace the System Management Interface Card in its original fitted position, i.e. ***the bottom EISA slot****.*

Installing

1. Study the expansion board's installation guide and follow its directions. The guide should tell you what kind of slot (i.e. PCI or EISA/ISA) you will use and whether there are any jumpers or switches on the card that you need to configure before fitting.
2. Remove the blanking plate from the rear panel access opening that corresponds to the chosen PCI or EISA slot.
   - ◊ Remember that one EISA/PCI slot is shared and therefore can only accept one card of either type.
3. Detach the SMIC ribbon cable from the SMIC card temporarily, to allow cards into the chamber.
4. Now fit the expansion card carefully into the slot. You can only install it in one orientation. If your card is full-length, be sure to insert one edge into the slider guide, attached to the cooling fan assembly metalwork, as you fit the card.

Position rules

Additional SCSI controllers	These must be fitted in one of the bottom three PCI slots to avoid boot-up conflicts with the onboard controllers.
RAID controllers	These should also be fitted to the lower slots.
PCI Ethernet cards	Fit from the topmost PCI slot downwards.
EISA Ethernet cards	Any slot bar the lowest, which is strictly reserved for the SMIC.

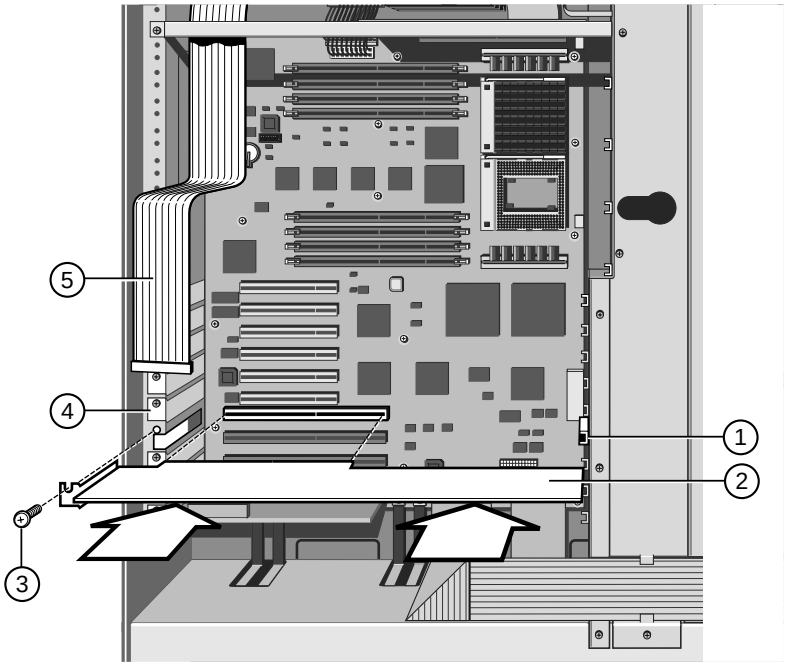


Figure 2-13 Fitting an Expansion Card

1	Card end guide/support	4	Blanking plates
2	Expansion Card	5	SMIC cable
3	Securing Screw		

1. Ensure that the card is firmly seated in its slot, but do not use excessive force.
2. Fasten the card in place using the blanking plate securing screw.
3. Fit any required cables to the board, ensuring their correct orientation. Do not allow them to obstruct airflow from any of the cooling fans.
4. Refit the SMIC ribbon cable to the SMIC card.
5. Run the EISA Configuration Utility (ECU) to complete the installation process. Full details are in the preceding chapter.

Caution

Remember to copy the RAMdrive back to the Flash disk on the ECU. Otherwise any configuration files added or updated will be lost when you exit the ECU.

Removing

1. Unplug all cables connected to the board and remove them completely.
2. Remove the securing screw and pull the board out of the slot, leaving an empty space on the rear panel for the blanking plate again.
3. Replace the original blanking plate to cover the rear opening to maintain airflow integrity.
4. Run the EISA Configuration Utility (ECU) to inform the system that you have removed the board.

Caution

Remember to copy the RAMdrive back to the Flash disk on the ECU. Otherwise all the updated configuration files will still be present when you exit the ECU.

3 PRELIMINARY SERVICE INFORMATION

If a problem should develop in your server within the warranty period, you should first contact the authorised maintainer for an engineer to service the unit.

Ensure that only Apricot authorised spare parts are used.

Caution

Only authorised engineers should carry out the procedures described in this section. Your computer's warranty could be invalidated.

Topics covered	Chapter
Preliminary tasks, precautions, required tools	3
Hard Disk Drives Drive Module, Drive Module Backplane	4
Front bezel, Front panel Removable Media Drives	5
System Management Controller Board (SMC) SMC Cooling Fan Assembly	6
Hard disk and Motherboard Cooling Fan Assemblies Cooling fan sub-assembly	7
Motherboard, Processor card Motherboard Power Distribution Panel	8
Hard Disk, Removable media Bay Power Distribution Loudspeaker	9
Power Supply Units Optional Battery back up unit	10

Caution

Read carefully the preliminary information and other details overleaf before commencing any service work on the computer.

Preliminary Service Tasks

Before you can perform a service procedure, you **must** do one of the following:

Standard power supply units, no fitted battery:

1. Power down the system to Standby mode.
2. Unplug the power lead from the mains socket.
3. Remove the side panels following the instructions given in Chapter 2,

If a battery back up (BBU) is fitted:

1. Refer to the SMA and note down the value of the *TimeOnCharge* variable. This value expresses, in seconds, the remaining charge in the optional battery pack. Since isolating the battery back up unit (BBU) sets the *TimeOnCharge* variable to zero, you will need to reset the variable in the SMA after you have completed your service procedure and reinstated the battery link.
2. Power down the system to Standby mode.
3. Ensure that any battery is isolated by removing the link on the rear of the BBU.
4. Unplug the power lead from the mains socket.
5. Remove the side panels following the instructions given in Chapter 2,

Caution

When you have completed your service procedure, always refit the side panels before powering the server up again. The fitted side panels are essential to an effective cool air flow through the machine.

Antistatic Precautions

All electronic components and equipment are sensitive to static electricity. Even small electrostatic charges can render components useless or severely shorten their working life. You should always take preventive measures which generally involve:

- a common earth point
- an earthed bench or bench mat
- an earthed wrist strap

Note

An antistatic earthing stud is provided on the rear panel of the server.

The Appendix contains more details about antistatic precautions.

Equipment Required

You will need the following tools to work on the system unit:

- Side panel key
- Phillips No.2 (cross-head) screwdriver, (magnetised type will help)
- Flat blade screwdriver
- Spanners for rear port fixings (UNC) and SMI2C fixing pillars (M3)
- Socket set with fitting for M5 head (for bus bar connections)
- Torque wrench set to 5 Nm (for tightening bus bar connections)

4 HARD DISK DRIVES AND MODULES

Warning

Read completely the instructions detailed in chapter 3 at the beginning of the service section.

Hard Disk Drive

Your Apricot is equipped with SCSI hard disk drives which are hot pluggable, i.e. you can remove or fit them while the system is powered up. Use the following instructions if a specific hard disk needs to be replaced. You can identify a specific drive by observing the labelling scheme as shown in the following illustration:

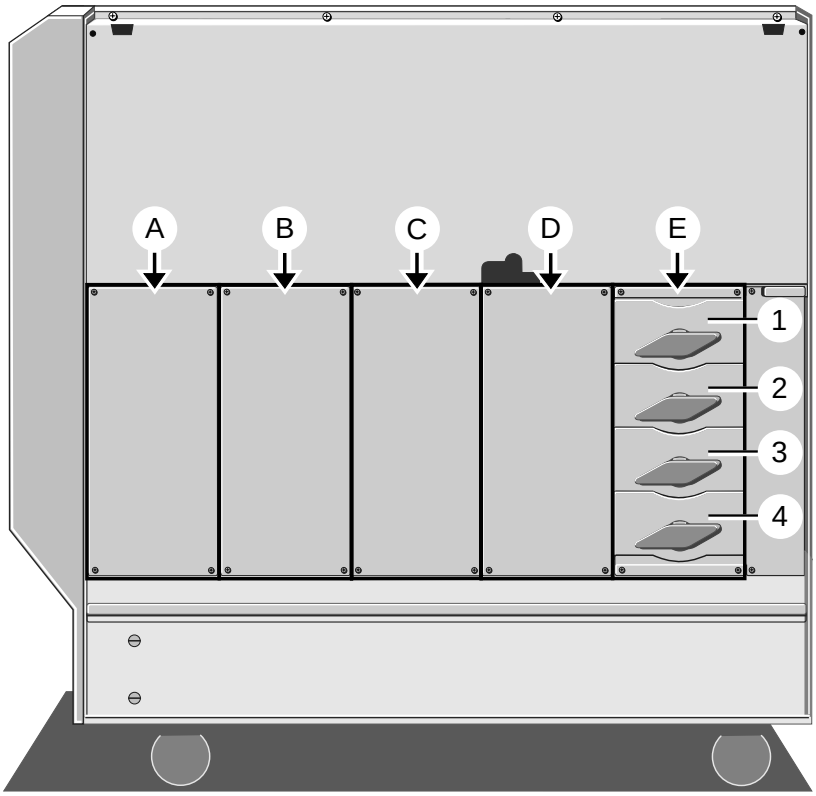


Figure 4-1 Disk Subsystem Labelling Scheme

In addition to the external labelling scheme, (the disk numbers within any module follow the same scheme) each SCSI drive, including the removable media drives, is assigned its own SCSI identification number.

As the system boots up, a list will appear for each SCSI adapter, listing the drives attached to it. It will also give drive SCSI identification numbers, along with brief details of each drive.

Caution

It may be wise to keep a separate written record of which trays are fitted with drives, along with their specification. Update this record with any changes or additions.

Removing a drive

1. Turn the hard disk tray release handle anti-clockwise until it stops, which is almost one complete turn. As you turn the handle, the tray ejects slightly.

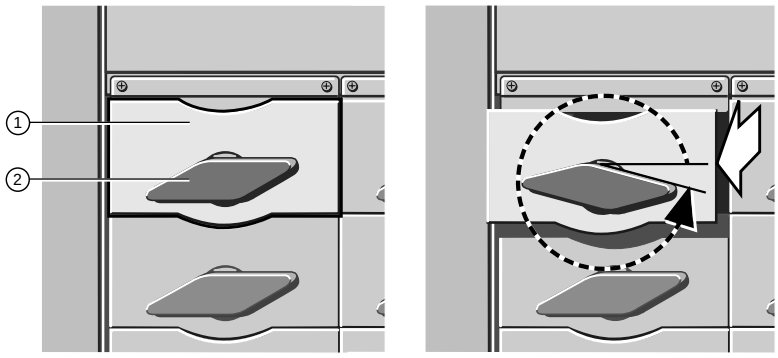


Figure 4-2 Release Handle Rotation

1	Disk Drive Tray	2	Disk Tray Release Handle

2. If you are removing the disk while the system is powered up, **wait at least 10 seconds** to allow the disk to stop spinning and the heads to park before continuing with this procedure.

Figure 4-3 Hard Disk Tray Removal

3. Slide the tray out carefully until it is free of the chassis.
4. Place the assembly into suitable packaging.

Note

Fitting additional hard disk drives and drive modules may require extra Power Supply modules, especially if another upgrade or expansion is being conducted at the same time. Consult your Apricot supplier. As a general guideline, each Power Supply module is rated at 267W (see chapter 10 for further information).

Fitting a replacement drive

Warning

The drive and tray require very accurate assembly or damage can be caused to the connections. This is done in the factory using special equipment. Damage may be caused by inaccurate assembly on site, which may invalidate your warranty.

1. Carefully unpack the new, ready assembled drive and tray from its protective packaging.

   ◊ Avoid touching the electronic control board or the connectors at the rear of the drive.

2. Ensure that the release handle on the tray is turned anti-clockwise as far as it will go.
3. Insert the tray into the drive module and push it carefully in until it reaches the point where the hard disk release handle will engage. You must not knock or jolt the hard disk drive.
4. Turn the hard disk release handle clockwise almost one complete turn until the tray metalwork is flush with the drive module. This procedure plugs the hard disk into the connectors on the drive module backplane.

Note

Since the hard disk drives for your Apricot are exclusively SCSI drives, it is important to note that the SCSI connector on the backplane of the drive module contains the device address. This means that, for a given connector, any disk drive that is fitted to that connector will have the same SCSI address.

Hard Disk Drive Module

The hard disk drive module is the removable metal framework which holds up to four hard disk drives. The server's disk chamber can accommodate up to five of these modules. Removal of a module will usually only be necessary if the circuit board on the module backplane fails.

Note

*You will need to ensure that **both** side panels are removed before attempting to remove or fit a drive module.*

Removing

1. Remove all hard disk drives which may be fitted to the module in question (see "Hard Disk Drive, Removing", earlier in this chapter).

Caution

It is vital that you remember the exact cable and connector arrangement of your hard disks, particularly if you are using a RAID (Redundant Array of Independent Disks) configuration. If you fail to restore the arrangement so that all cables, plugs and disks are as they were originally, you risk losing all the data on your hard disks.

1. In the electronics chamber, unplug the data ribbon cable from the connector on the back of the module. The connector is visible through an opening in the centre spine.

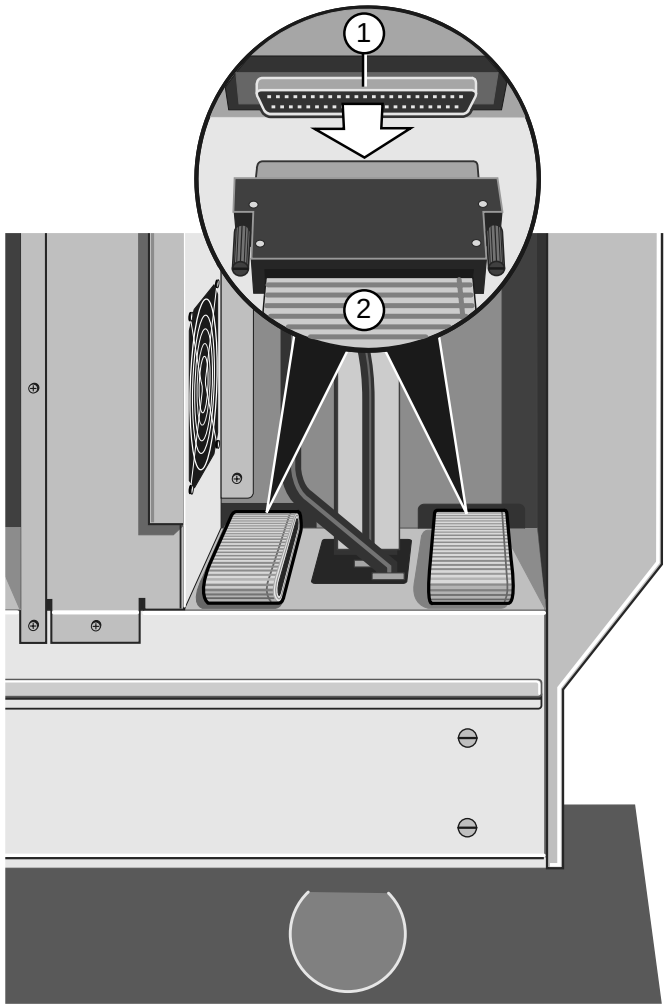


Figure 4-4 Unplugging the Ribbon Cable from a Module

1	Hard Disk Module Data Connector	2	Ribbon Cable

Note

One of the connectors, located underneath the cooling fan assembly, is less accessible than the others. If it is difficult to unplug this connector in the electronics chamber, feed the ribbon cable carefully through the centre spine opening. Then unplug the connector in the disk chamber.

3. Remove the four securing screws, as shown in the following diagram:

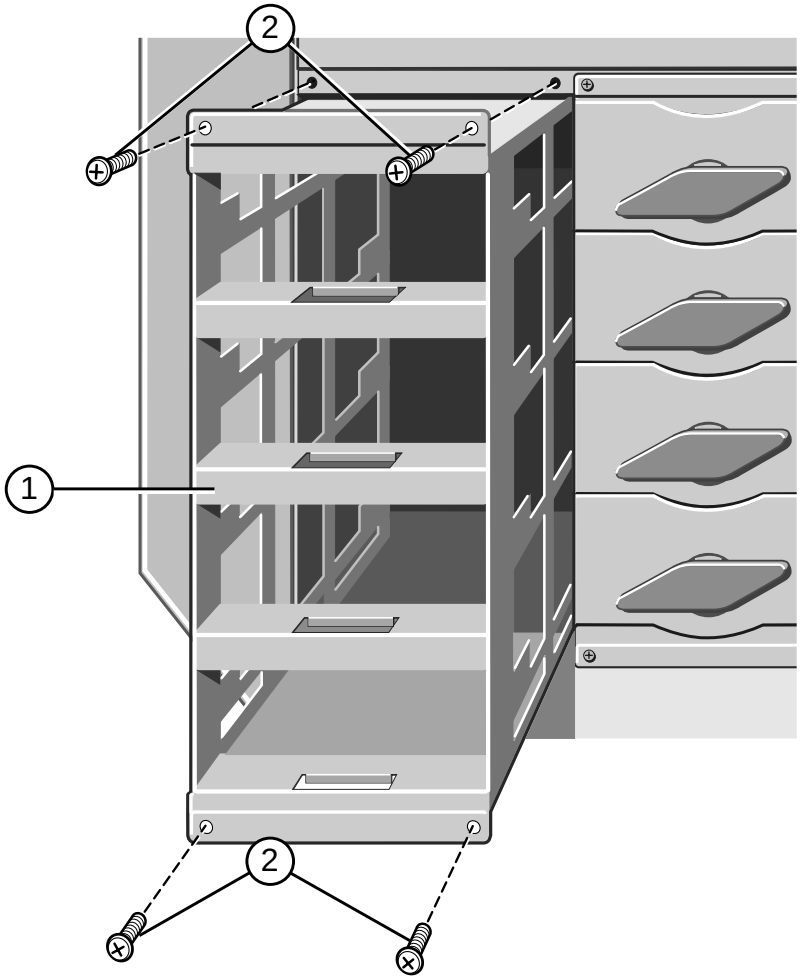


Figure 4-5 Removing a Drive Module

1	Empty Disk Drive Module	2	Securing Screws

4. Slide the module gently out. You will feel a little initial resistance as the backplane power connector unplugs from its socket on the centre spine of the server.

Hard Disk Drive Module Backplane

The backplane on a hard disk drive module consists of a circuit board which is slotted into the metal framework from the top.

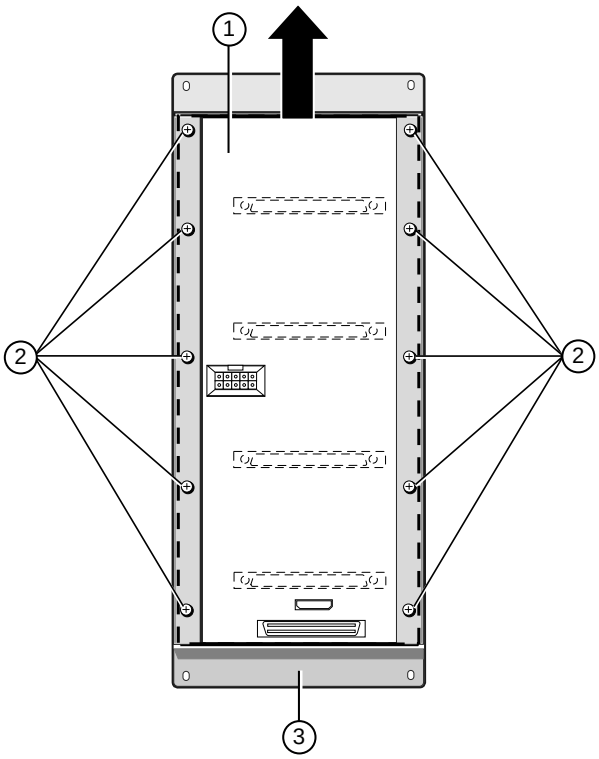


Figure 4-6 Hard Disk Drive Module Backplane

1	Backplane circuit board	3	Drive module (rear)
2	Clamping screws		

Removing backplane

There are ten fastening screws for the board. To remove the backplane:

1. Ensure all disk drives have been removed from the module.
2. Remove the clamping screws from the board.
3. Lift it upwards carefully until it is free from the module framework. Take full antistatic precautions with this board.

Refitting backplane

1. Manoeuvre the board into the slot from the top, ensuring it is the correct way round and that the control side connector is at the bottom, as shown above.
2. Refit all the clamping screws to the module framework, as shown in the above illustration.

Caution

It is very important that all fixing screws are refitted to prevent damage to the board or drive connectors when fitting or removing hard drive trays.

Refitting module

1. Slide the drive module into place as far as it will go, at the same time guiding the data connector through the opening in the centre spine.
2. Now reach inside the module and push carefully but firmly on the power circuit board on the backplane to ensure that its connector is seated fully into the power socket on the centre spine. The power connection is in the centre of the backplane in each module as shown in the following diagram:

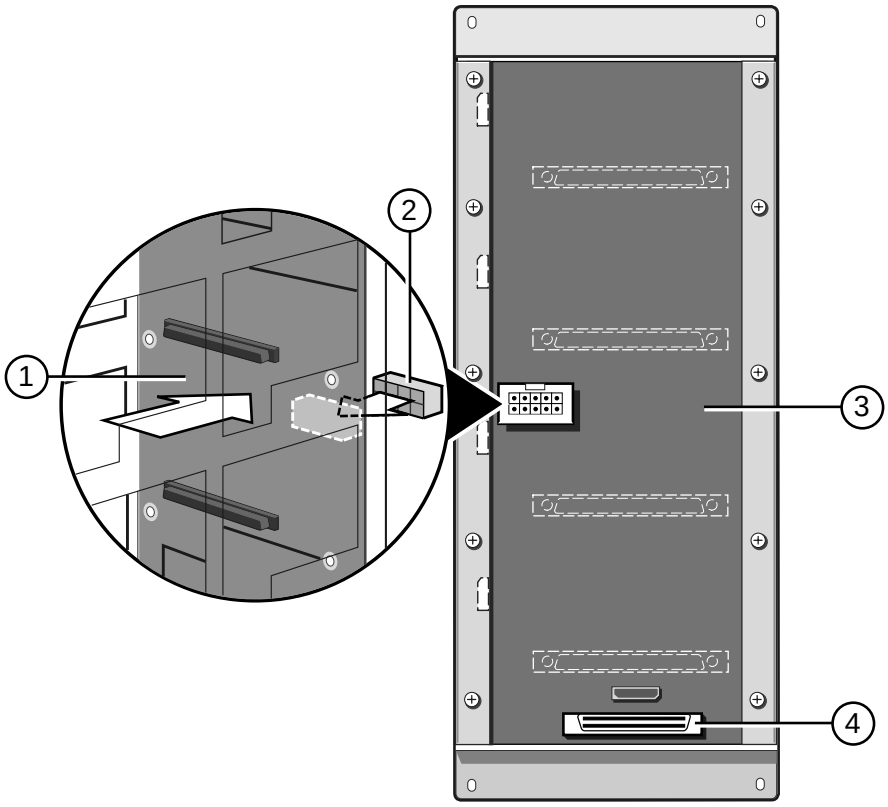


Figure 4-7 Seating Power Connector

1	Power Circuit Board (from inside module)	3	Power Circuit Board (from rear of module)
2	Power Socket on Centre Spine	4	SCSI bus connector

4. Now use the four screws to fasten the module to the subsystem metalwork in the drive chamber, as in *Figure 4-5*.

Caution

It is vital that you remember the exact cable and connector arrangement of your hard disks, particularly if you are using a RAID (Redundant Array of Independent Disks) configuration. If you fail to restore the arrangement so that all cables, plugs and disks are as they were originally, you risk losing all the data on your hard disks.

5. In the electronics chamber, plug the appropriate ribbon cable onto the data connector on the backplane of the drive module:

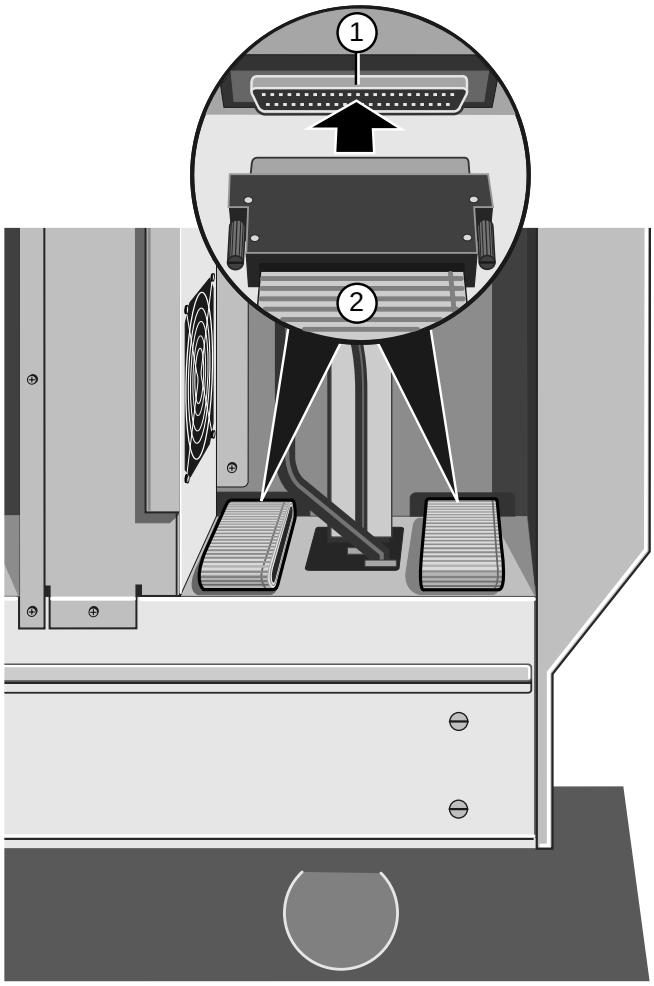


Figure 4-8 Plugging the Ribbon Cable to a Module

1	Hard Disk Module Data Connector	2	Ribbon Cable

6. Carefully reinsert the hard disk trays into the drive module, following the instructions given earlier in the chapter. Make sure that each disk is replaced in its original position.

5 FRONT PANELS AND DRIVES

Warning

Read completely the instructions detailed in chapter 3 at the beginning of the service section.

Front Bezel

Removing

1. Ensure that the removable media drive bay door is closed and locked.
2. On each side of the server, remove the protective metal plates which cover the removable media drives and the electronics chamber.
3. Remove any hard disk drive module close to the front of the machine. For detailed information see previous chapter.
4. Remove eight screws, four on each side of the machine, and slide the bezel away from the chassis as shown in the following diagram:

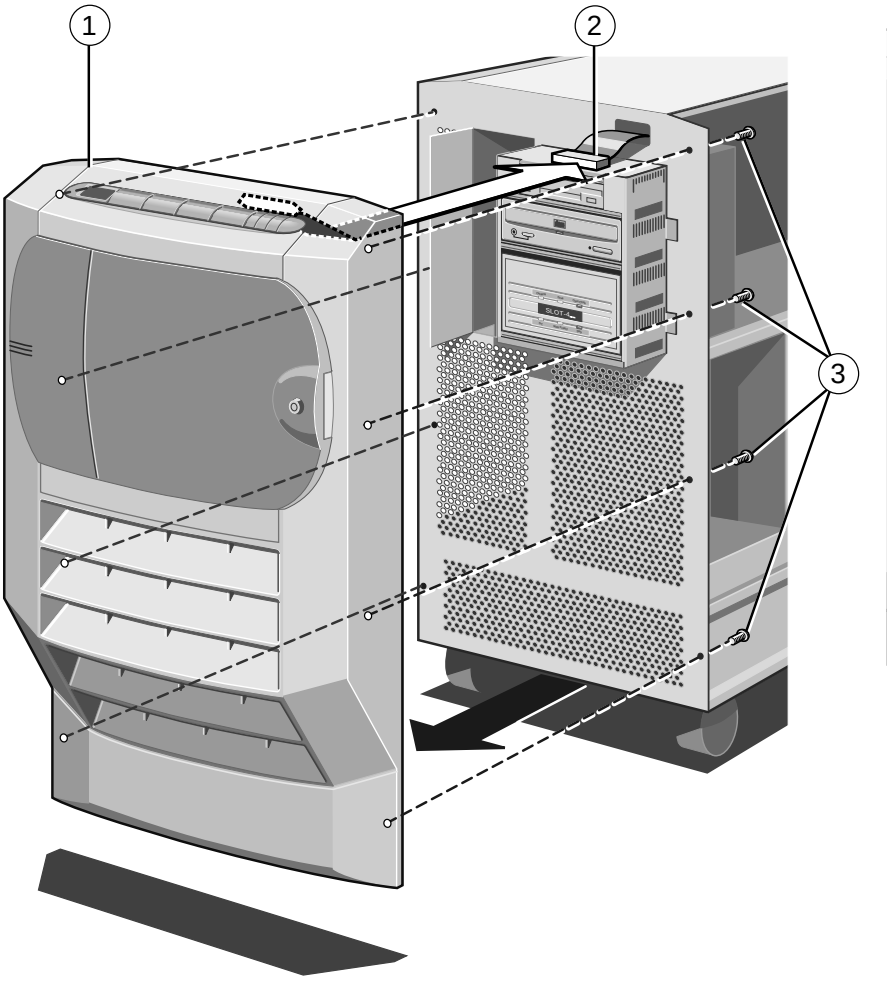


Figure 5-1 Removing Front Bezel

1	Front Bezel	3	Securing Screws (x 8)
2	Front Panel System Controller Connector		

5. The front panel is attached to the bezel and comes away from the chassis at the same time. Since there is a ribbon cable attached to the front panel, remove the bezel with care.
6. Reach behind the bezel and disconnect the ribbon cable from the front panel.

Fitting

1. Ensure that any hard disk drive module close to the front of the machine is removed.
2. Plug the ribbon cable into the connector on the front panel.
3. Fit the bezel onto the chassis and connect the eight screws, four on each side of the server, as shown in the following diagram:

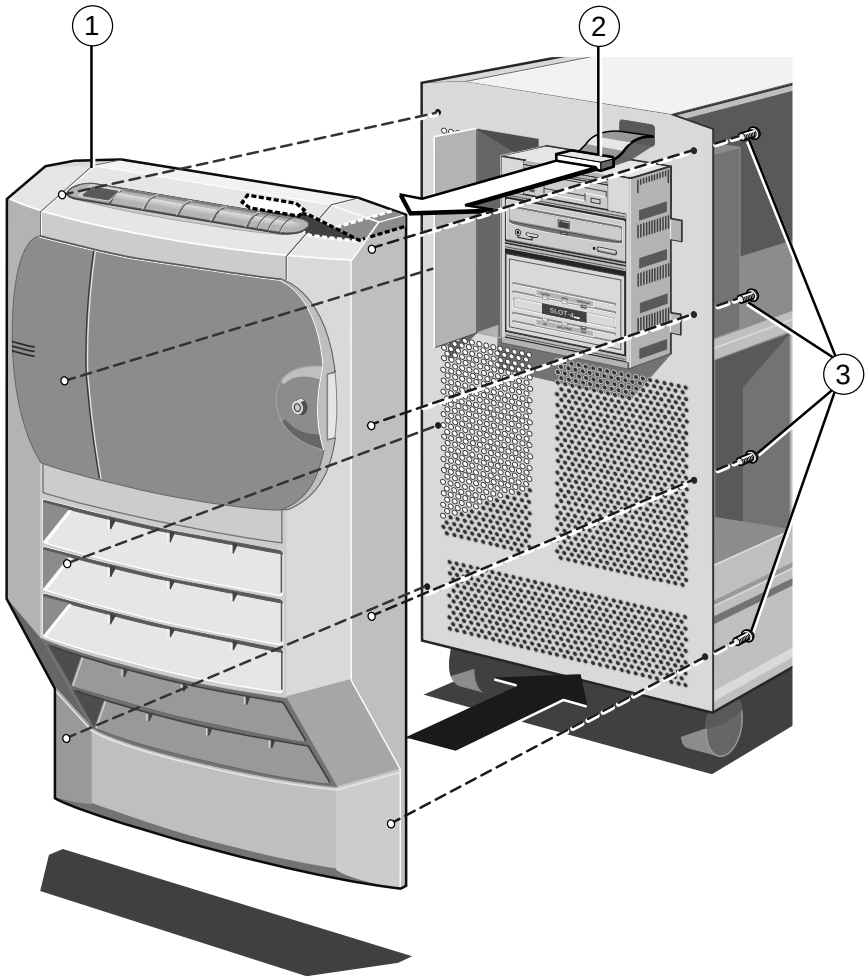


Figure 5-2 Refitting Front Bezel

1	Front Bezel	3	Securing Screws (x 8)
2	Front Panel System Controller Connector		

Front Panel

Removing

1. With the front bezel removed and the ribbon cable disconnected from the front panel, remove the circlip from the top hinge of the removable media drive bay door (which should be closed and locked).

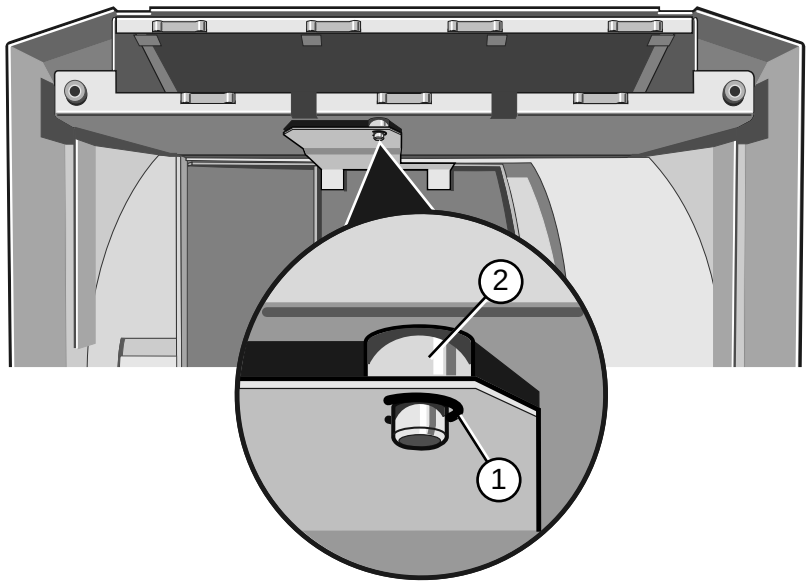


Figure 5-3 Removing the circlip

1	Circlip	2	Top Hinge of Drive Bay Door

2. Gently press down on the metal plate to detach it from the hinge as shown:

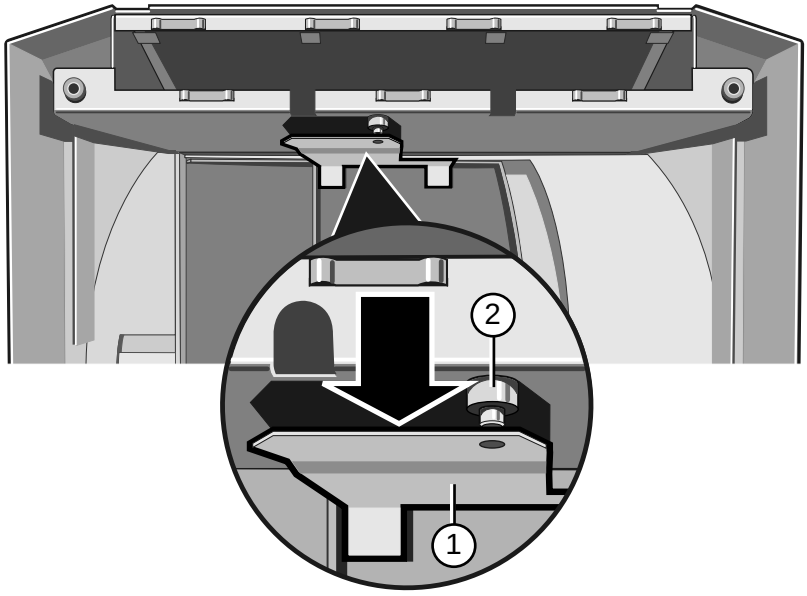


Figure 5-4 Detaching the Hinge

1	Metal Plate	2	Hinge

3. Now remove the two screws as shown:

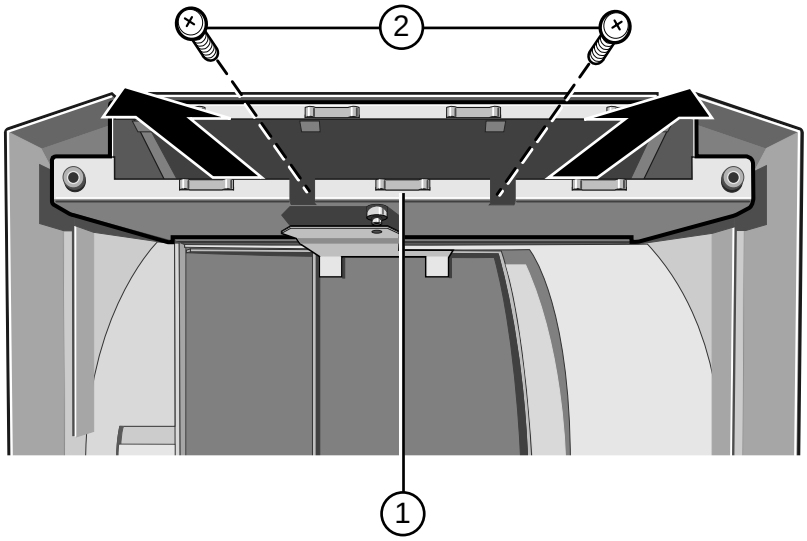


Figure 5-5 Removing Front Panel Supporting Metalwork

1	Front Panel Supporting Metalwork	2	Securing Screws

4. Slide the supporting metalwork out of the bezel.
5. Remove the eight screws which fasten the front panel onto the metalwork:

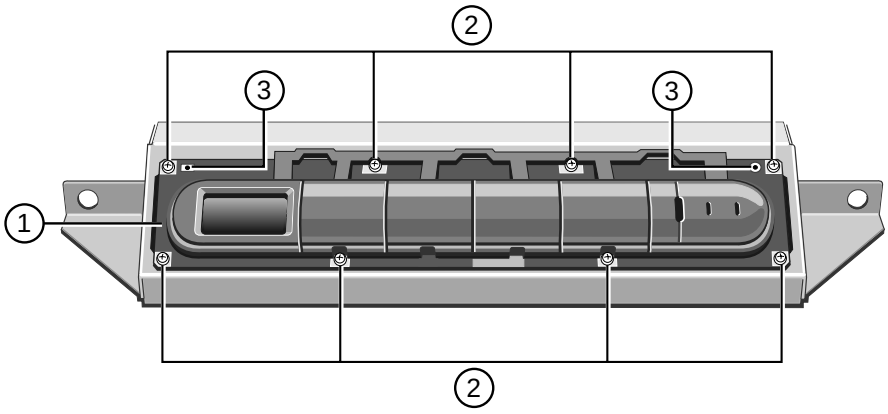


Figure 5-6 Front Panel Securing Screws

1	Front Panel	3	Metal Protrusion Holes
2	Securing Screws		

6. Remove the front panel.

Fitting

1. Attach the front panel to the supporting metalwork by means of the eight screws as shown:

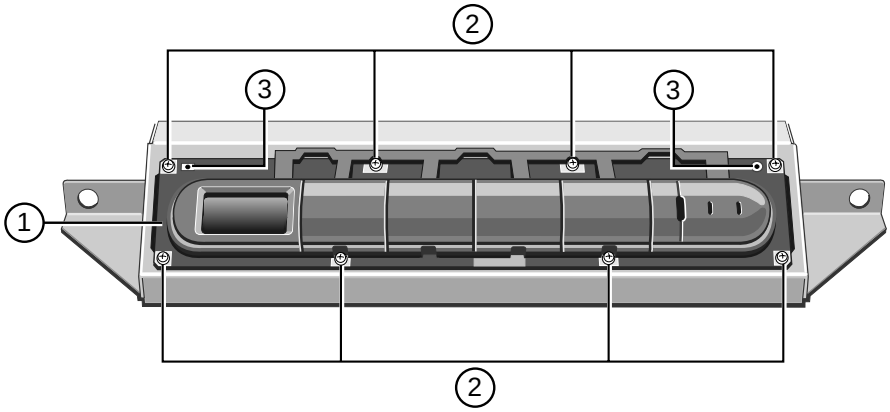


Figure 5-7 Front Panel Securing Screws

1	Front Panel	3	Metal Protrusion Holes
2	Securing Screws		

Note

Be sure to fit the two securing holes, marked '3', over the small metal protrusions in the metalwork.

2. Insert the front panel framework into the bezel as shown:

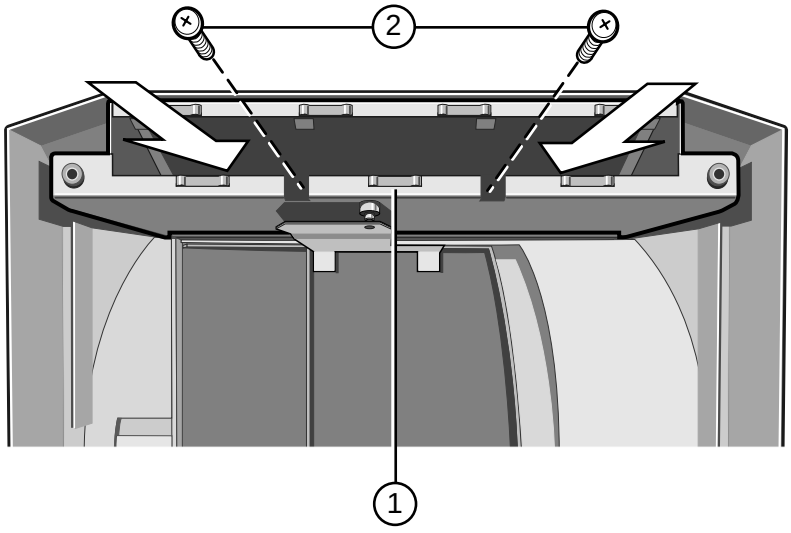


Figure 5-8 Fitting Front Panel Supporting Metalwork

1	Front Panel Supporting Metalwork	2	Securing Screws

3. Fasten the framework onto the bezel using the two screws.
4. Attach the top hinge of the removable media drive bay door to the front panel supporting metal work you just fitted.

5. Fit the circlip into the hinge as shown in the following illustration:

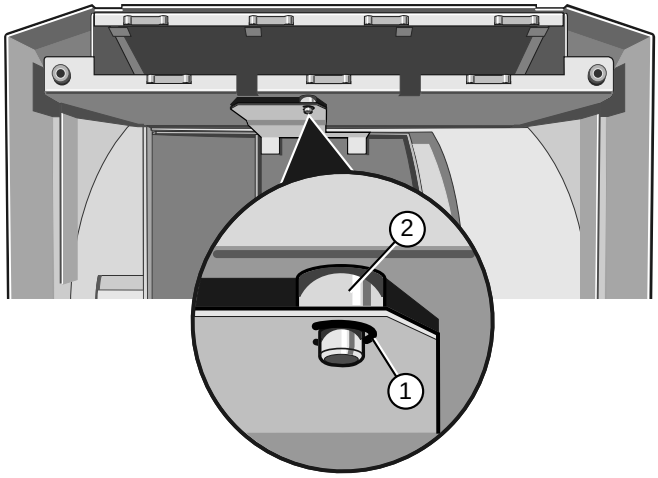


Figure 5-9 Fitting Circlip

1	Circlip	2	Top Hinge of Drive Bay Door

Removable Media Drives

To gain access to the removable media drives and the System Management Controller (SMC) you must first remove the protective metal plate which covers this area.

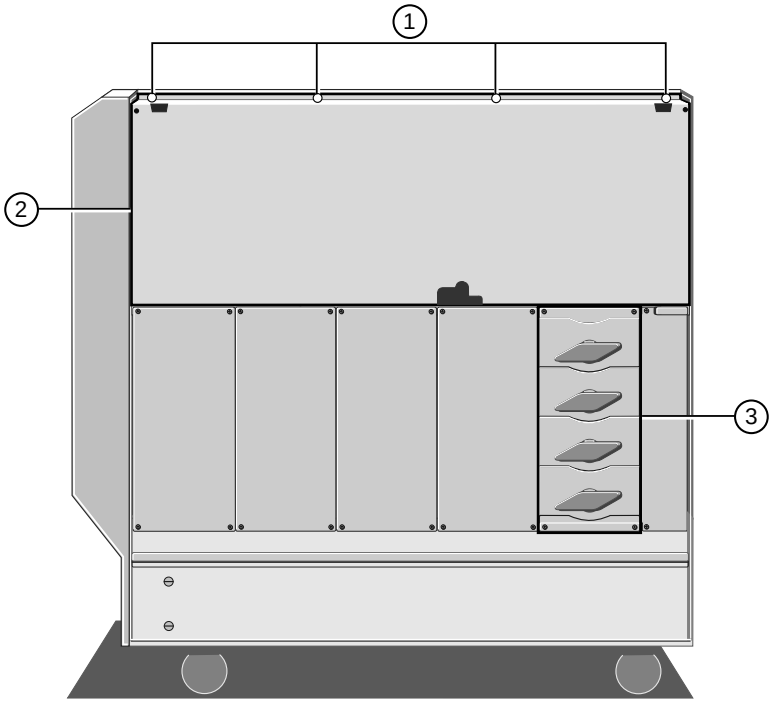


Figure 5-10 Removing Protective Metal Plate

1	Securing Screws	3	Hard Disk Subsystem
2	Protective Metal Plate		

1. Remove the securing screws.
2. Use the finger holes near the top left and right-hand corners to lift the plate away from the server.

Removing the drive cage

Each drive is attached to a drive tray, which is in turn secured to the drive cage. To remove a tray from the cage:

1. Unplug the data and power cables from the rear of the drive. Unplug the other end of the power cable from its socket on the centre spine.
2. Remove the two drive tray securing screws from the side of the cage. The following diagram shows the screws for three of the drives:

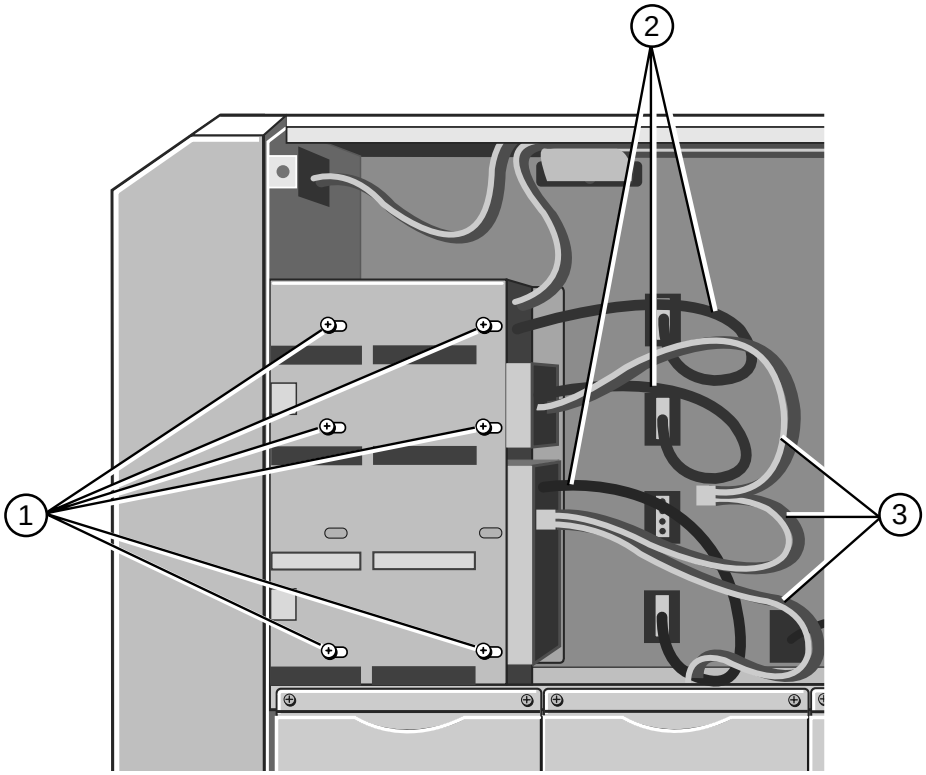


Figure 5-11 Removable Media Drive Bay (Internal)

1	Drive Tray Securing Screws	3	Drive Data Cables
2	Drive Power Cables		

3. Slide the tray carefully toward the rear of the cage until it is free from the metalwork.
4. Turn the tray over and remove four screws from the underside.

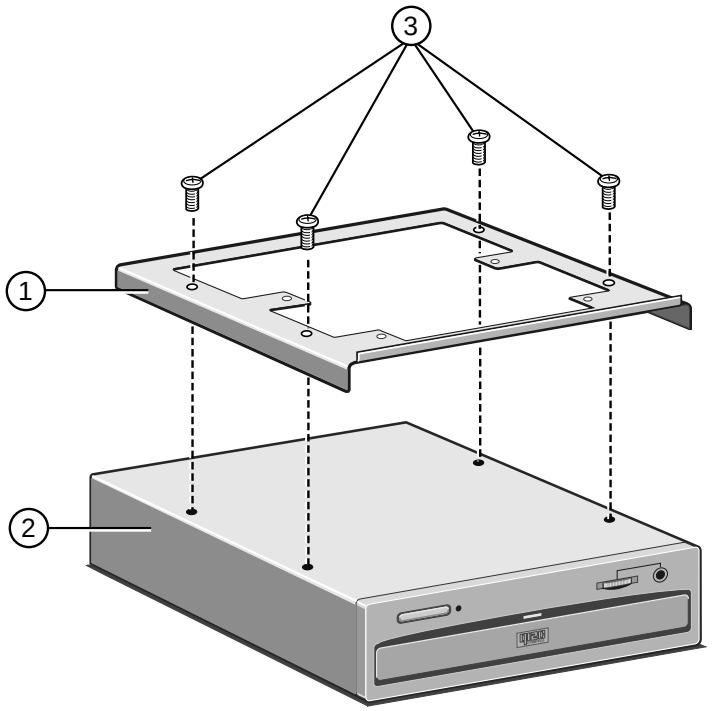


Figure 5-12 Drive Tray Removal

1	Drive Tray	3	Securing Screws
2	Drive Assembly		

5. Lift the tray away from the drive.

Fitting

Your server is equipped with a tray and a blanking plate for each empty drive bay.

1. Remove the blanking plate, if necessary, from the drive tray. The plate is attached via two screws on the underside of the tray.
2. Fasten the drive onto a drive tray using the four securing screws as shown above. The tray allows for a small amount of adjustment. Align carefully, if the drive is too far forward it may prevent the front panel door from closing.
3. Turn the drive upright, slide it into the drive cage and secure it to the cage using the two screws.
4. Connect the power cable to the back of the drive and the other end to the socket on the centre spine.
5. If you are fitting a SCSI drive, you will need to connect it to the bus cable which is attached to any other SCSI removable media drives that are present.

Note

When fitting SCSI devices, the unit ID must be set so as not to conflict with any other SCSI device already in the system. It is advisable to keep a secure written record of all devices, IDs and their function/position.

6 SYSTEM MANAGEMENT CONTROLLER BOARD AND FAN

Warning

Read completely the instructions detailed in chapter 3 at the beginning of the service section.

Although some of the board is hidden behind the cooling fan assembly, all of the fixing screws and cable connections are easily accessible.

System management controller (SMC)

Removing

1. Take careful note of where each connection is from and unplug three ribbon cable connectors, the power connector, three fan connectors, two thermistor connectors and one keylock sensor cable connector as shown in the following diagram.

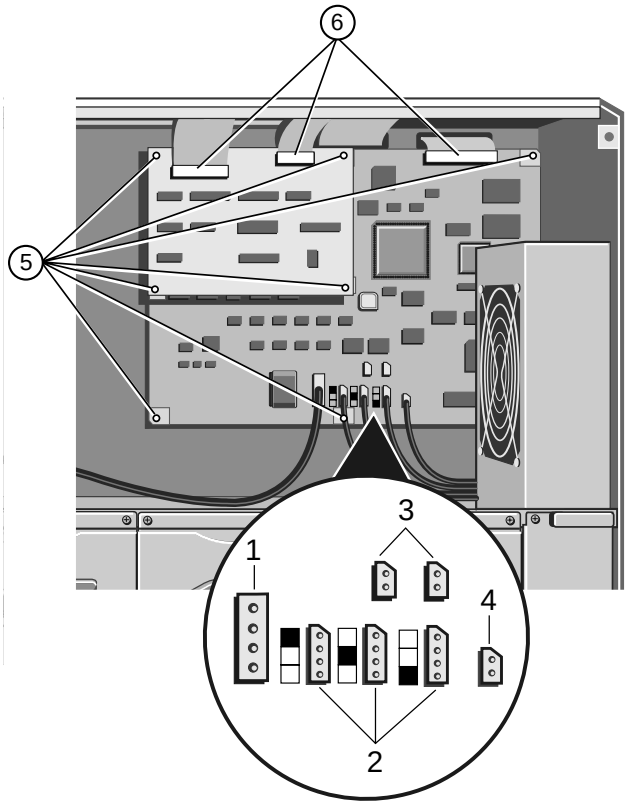


Figure 6-1 System Management Controller Board

1	Power Connector	4	Keylock Sensor Connector
2	Fan Connectors	5	Securing Screws
3	Thermistor Connectors	6	Ribbon Cable Connectors

2. Remove the securing screws detailed above.
3. Carefully unplug the SMI2C daughterboard and put in a safe place.
4. Remove the four stand-off screwlock pillars from the SMC board that are used to mount the SMI2C daughterboard.

5. Remove the two screw lock posts on the 25-way SMC serial port connector which is visible on the server's back panel and lift the SMC board clear.

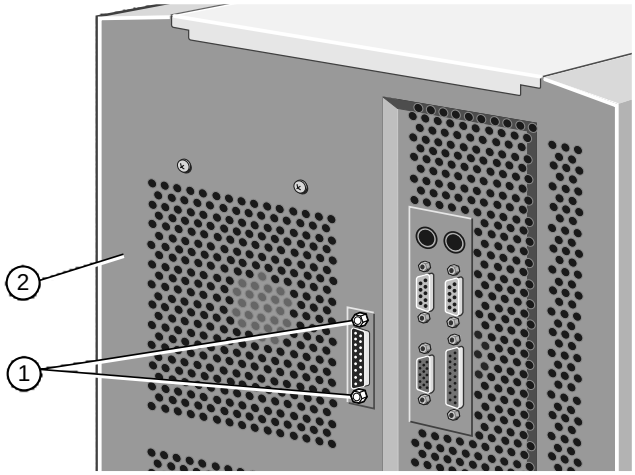


Figure 6-2 SMC Serial Port Screw Lock Posts

1	Screw Lock Posts	2	Back panel

Fitting

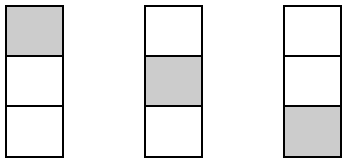
1. Feed the 25-way serial port connector through the opening in the back panel.
2. Fasten the board to the centre spine using the four screwlock stand-off pillars as previously removed.
3. Fasten the two screwlock posts into place at both ends of the 25-way connector on the back panel. Do not overtighten.
4. Plug in the SMI2C daughterboard to the top left sockets of the SMC.
5. Refit the remaining screws as shown in *Figure 6-1.*
6. Plug the ribbon cables, power cable, fan and associated thermistor cables and the keylock sensor cable into their respective connectors on the SMC board as shown in *Figure 6-1*.

   ◊ Ensure the daughterboard is correctly seated on the connectors at the top left of the SMC board and that the correct two ribbon cables are fitted to the sockets on it.

Caution

Ensure the ribbon cables from the front panel and the PSU are in their correct positions or damage will be caused to the SMC board.

Against each fan connector on the board there is a graphic which indicates which fan cable should be plugged in:



Top Middle Bottom

The middle and bottom fans in this series are located below the SMC board in the disk subsystem area.

System Controller Cooling Fan Assembly

Removing

1. Unplug the top fan connector on the SMC board (see fan connector graphic in "System Management Controller Board, Fitting").
2. Remove the two securing screws for the fan assembly, found on the back panel as shown:

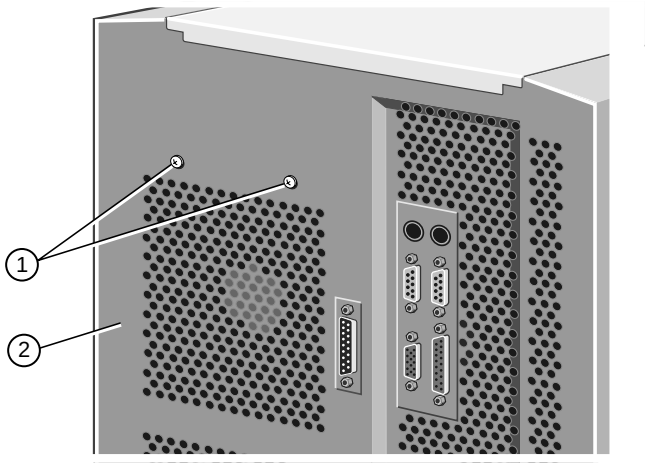


Figure 6-3 SMC Cooling Fan Securing Screws

1	Securing Screws	2	Back panel

3. Tilt the top of the assembly slightly towards the interior of the server (if it hasn't already) and lift it upwards to free it from the chassis.

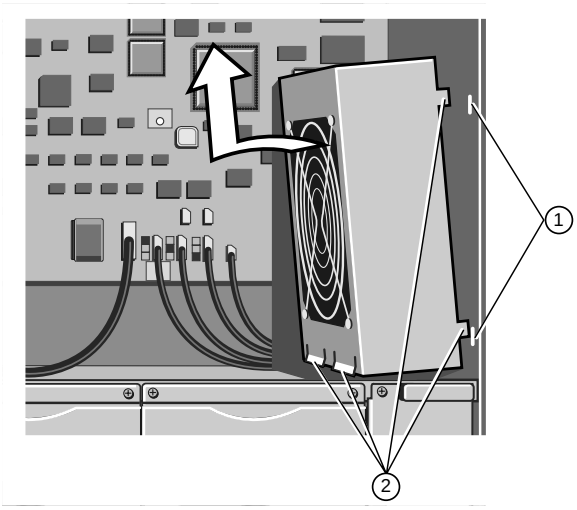


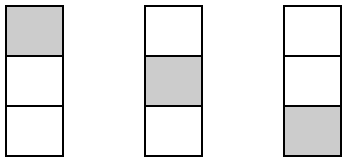
Figure 6-4 SMC Fan Assembly

1	Tab Slots	2	Metal Tabs

Fitting

1. Fit the assembly so that the two metal tabs at the bottom are inserted into corresponding slots. The assembly will then have a natural tilt towards the interior of the server.
2. On each side of the assembly there is also a smaller tab which fits into a corresponding slot in the chassis. Squeeze the sides gently until the tabs fit into the slots.
3. While holding the assembly in place, fasten it with the two screws on the back panel of the server.
4. Connect the fan cable to the **top** connector on the controller board.

Against each fan connector on the board there is a graphic which indicates which fan cable should be plugged in:



Top Middle Bottom

For further information about dismantling the fan sub-assembly, see the following chapter, which provides detailed instruction on the rest of the internal system fans.

7 COOLING FANS

Warning

Read completely the instructions detailed in chapter 3 at the beginning of the service section.

Hard Disk Drive Cooling Fan Assembly

You can remove and fit the hard disk drive cooling fan assembly without disturbing the adjacent disk drive module.

Removing

1. Unplug the middle and bottom fan connectors and their associated thermistor connectors from the SMC board as shown:

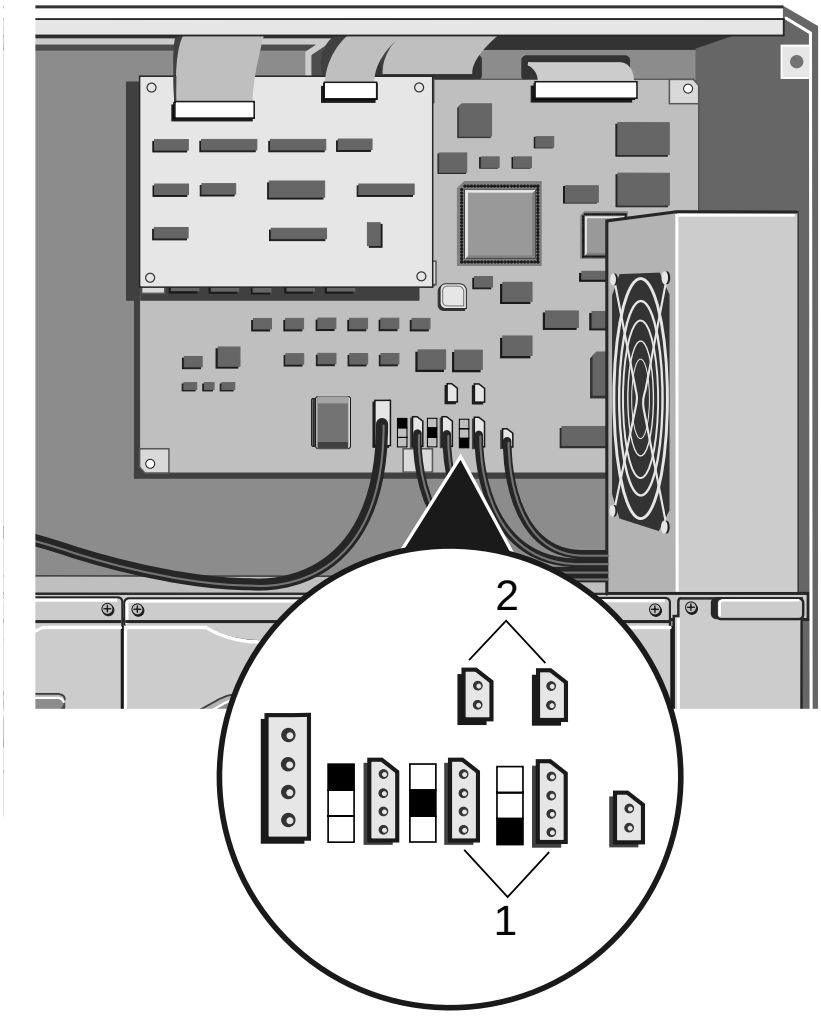


Figure 7-1 SMC Fan and Thermistor Connectors for Middle and Bottom Fans

1	Middle & Bottom Fan Connectors	2	Associated Thermistor Connectors

2. Push the power and thermistor cables down through the cut-out in the corner of the metal work behind the top fan assembly.

3. Remove two screws which fasten the fan assembly to the chassis:

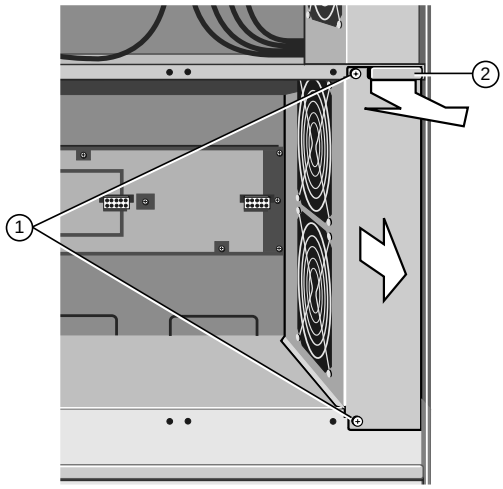


Figure 7-2 Removing the Hard Disk Cooling Fan Assembly

1	Securing Screws	2	Finger Grip

4. Use the finger grip to slide the assembly towards you.

Fitting

1. Slide the assembly into position, remembering to feed the guide tabs into the positioning slots as shown in the following illustration:

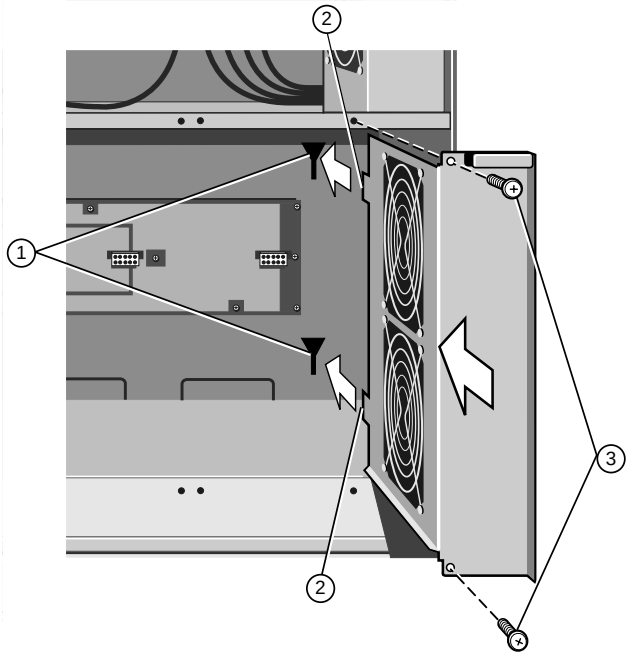


Figure 7-3 Refitting Hard Disk Cooling Fan Assembly

1	Positioning Slots	3	Securing Screws
2	Guide Tabs		

2. At the same time, feed the fan cables through the cut-out in the corner of the metalwork above the assembly. These cables will need to be plugged into their respective sockets on the SMC board.

3. Fasten the assembly to the chassis with the two screws.

4. Plug the bottom and middle fan connectors, together with their associated thermistor connectors, in to the SMC board as indicated in the following diagram:

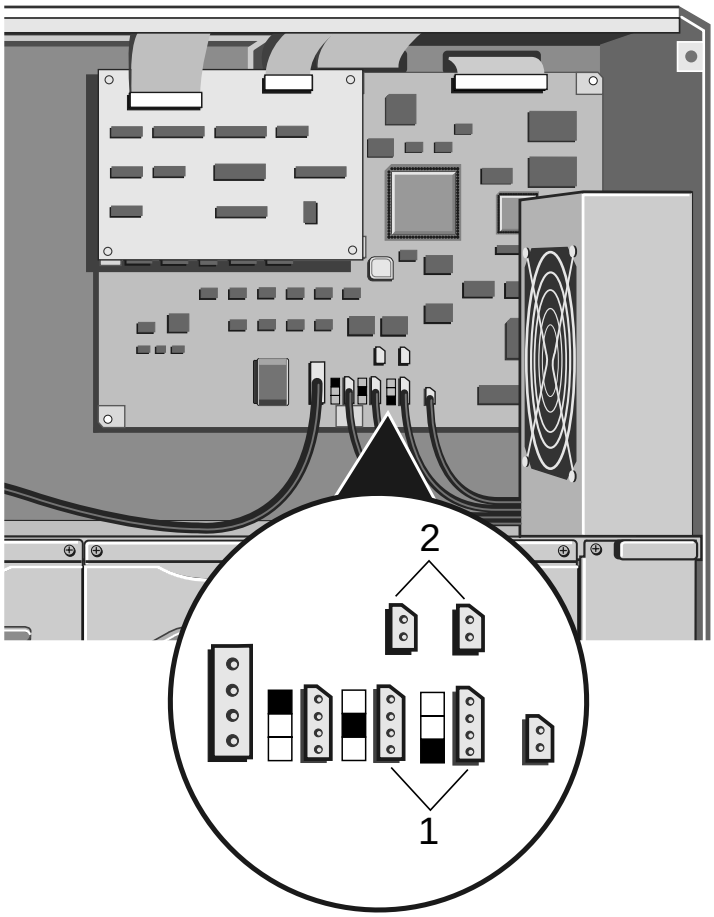
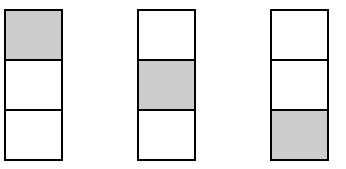


Figure 7-4 SMC Fan and Thermistor Connectors for Middle and Bottom Fans

1	Fan Connectors	2	Thermistor Connectors

5. Check that all fan and thermistor connections are correctly orientated before switching on and that all side panels are securely fitted.

◊ The SMC board is marked to show which fans plug in to which socket:



Top Middle Bottom

Motherboard Cooling Fan Assembly

Removing

1. Remove five screws on the side of the fan assembly.
2. Remove any support struts fitted across the motherboard.
3. Remove four more screws which fasten the assembly to the centre spine of the server, as shown:

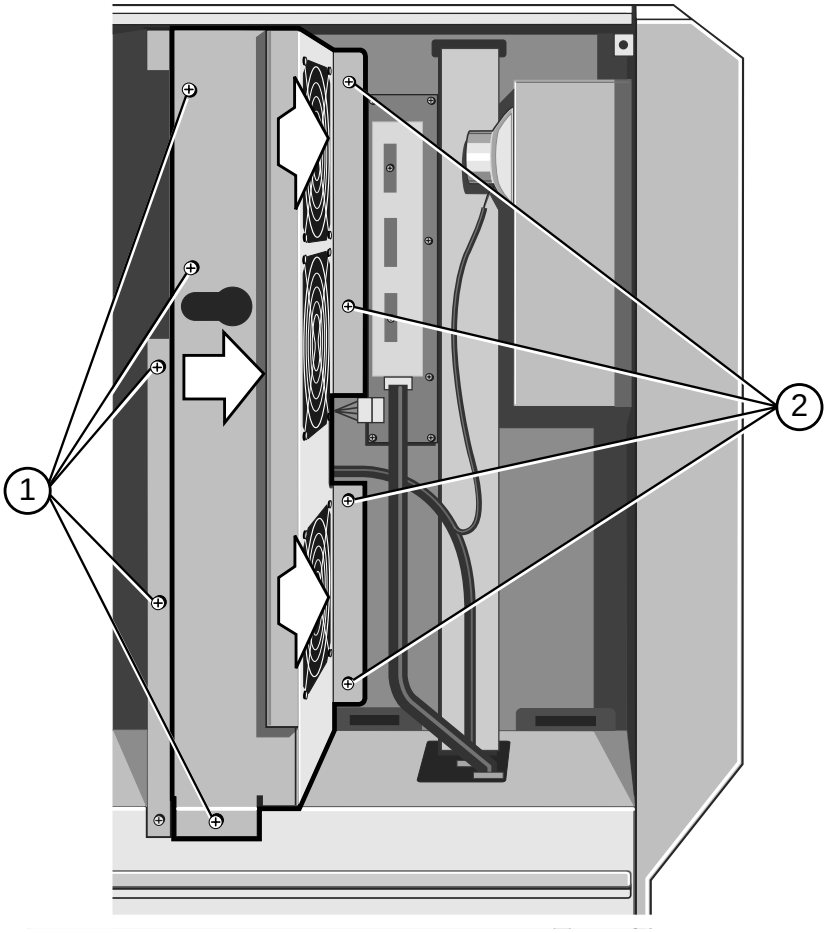


Figure 7-5 Removing Cooling Fan Assembly

1	Side Securing Screws	2	Centre Spine Securing Screws

4. Slide the assembly to the right and then towards you to disengage it.
5. Before removing the assembly entirely, unplug the ribbon cable from the connector on the small power distribution panel between the bottom and middle fans:

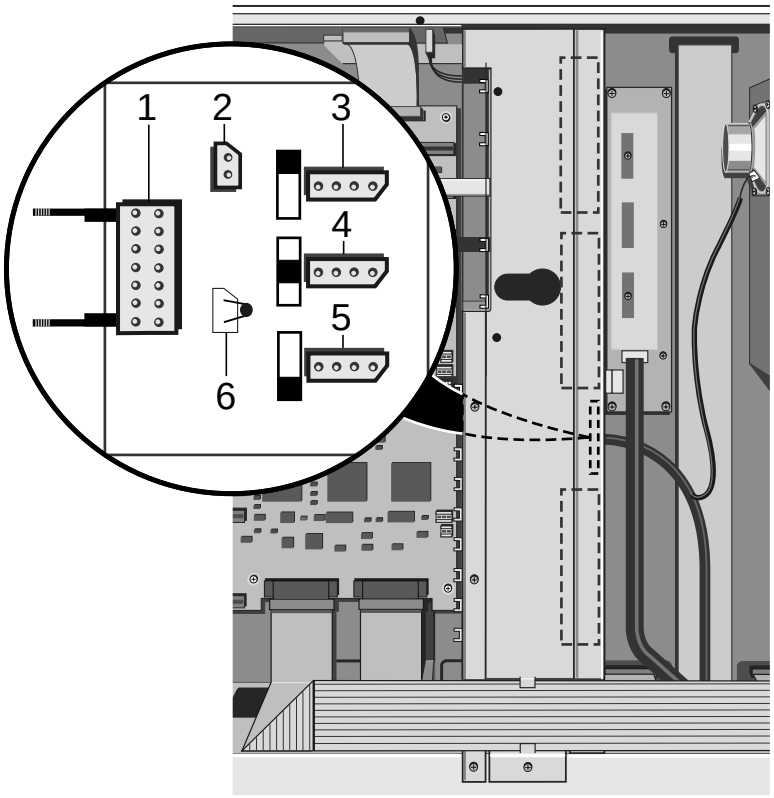


Figure 7-6 Connectors on Small Power Distribution Panel

1	Ribbon cable connector	3,4,5	Fan power connectors
2	Side panel lock connector	6	Temperature sensor

Fitting

1. Fit the fan assembly into the interior of the server enough to connect the ribbon cable to the small power distribution board between the middle and bottom fans. Ensure the clips are latched onto the connector body.
2. Slide the assembly to the left into place and fasten it to the chassis by means of four screws at the centre spine and five screws at the side.
3. Replace any card support struts across the motherboard.

Removing fan from sub-assembly

These following instructions apply to all the fans in the server including any described in other chapters.

Remove the four screws which hold the handguard onto the fan assembly housing. This not only releases the handguard, but also the fan itself.

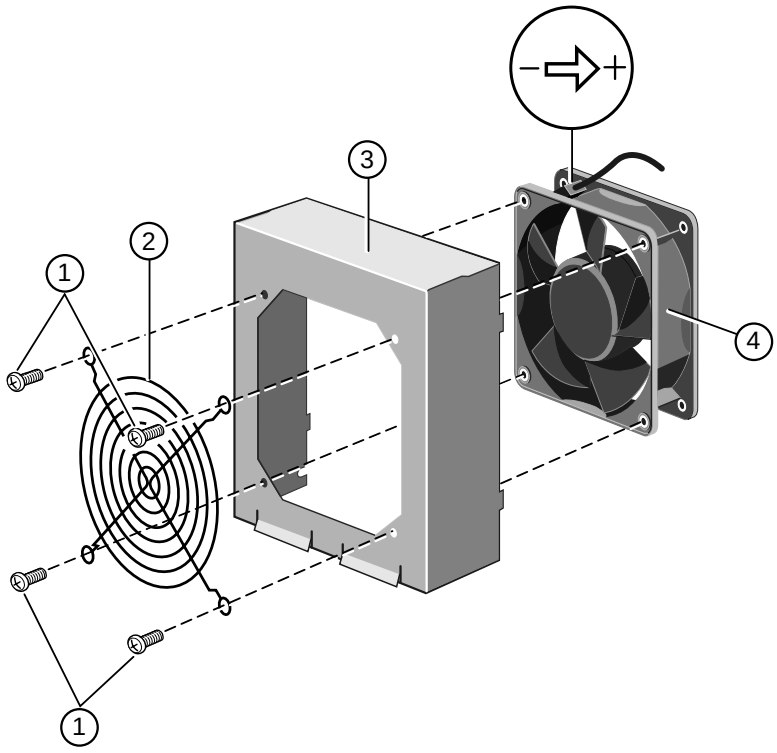


Figure 7-7 Cooling Fan Assembly

1	Securing Screws	3	Fan Assembly Housing
2.	Handguard	4	Fan

Fitting

Caution

Before attempting to fit the fan onto the fan assembly housing, be sure to place the fan into the assembly so that the air flow through it is from the front of the server to the rear (see the arrow next to the electrical polarity marking on one corner of the fan). If any fan is turned the wrong way around, it will seriously reduce the overall cooling effectiveness and increase the risk of overheating.

1. With the housing upright, align one corner of the handguard with a screw hole and insert a screw just a few turns.
2. While holding the handguard and screw in place, align the fan to the other holes and insert a second screw.
3. In a similar way, align and fit the remaining screws. Tighten when all are in place. Do not overtighten or this may damage the fan housing.

8 MOTHERBOARD AND POWER BOARD

Warning

Read completely the instructions detailed in chapter 3 at the beginning of the service section.

This chapter details the removal and refitting of the Motherboard, additional processor board and associated Power board. Each one has a separate procedure.

System motherboard

Removing

1. Unplug all external cables and leads from the system back panel connectors (i.e. serial, parallel, video, keyboard, mouse) on the motherboard and from any expansion cards.
2. Remove the screws which secure the metal plate over the electronics chamber. The screws are along the top and right edges of the plate as shown in the following illustration:

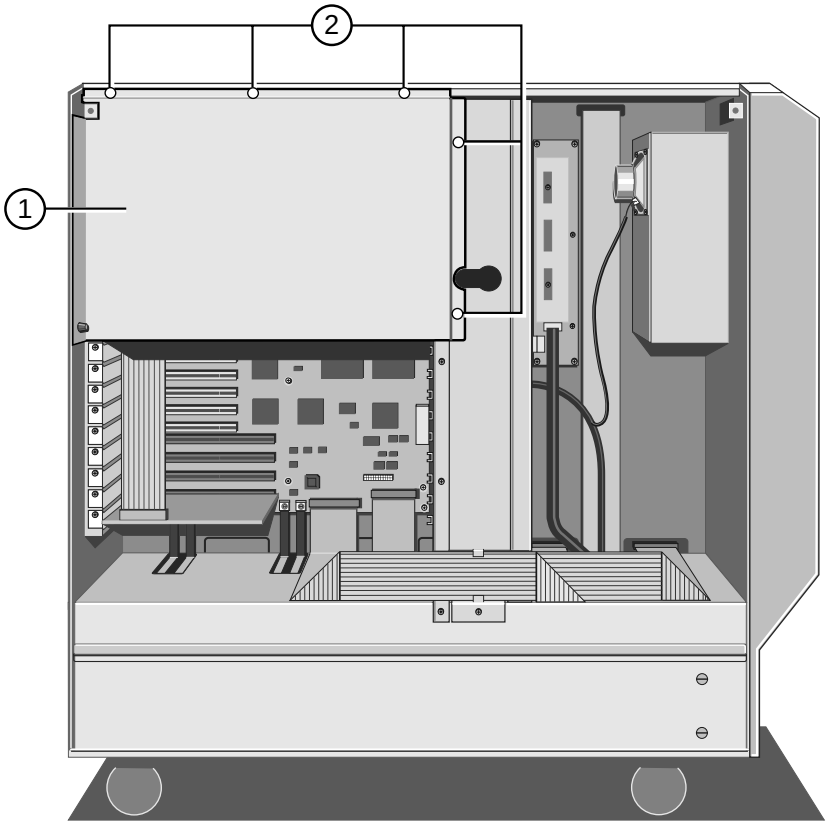


Figure 8-1 Protective Metal Plate Over Motherboard

1	Protective Metal Plate	2	Securing Screws

Caution

It is vital that you remember the exact cable and connector arrangement of your hard disks, particularly if you are using a RAID (Redundant Array of Independent Disks) configuration. If you fail to restore the arrangement so that all cables, plugs and disks are as they were originally, you risk losing all the data on your hard disks.

3. Rotate the right edge of the plate slightly towards you and unhook the left edge. Removing the plate uncovers the motherboard:

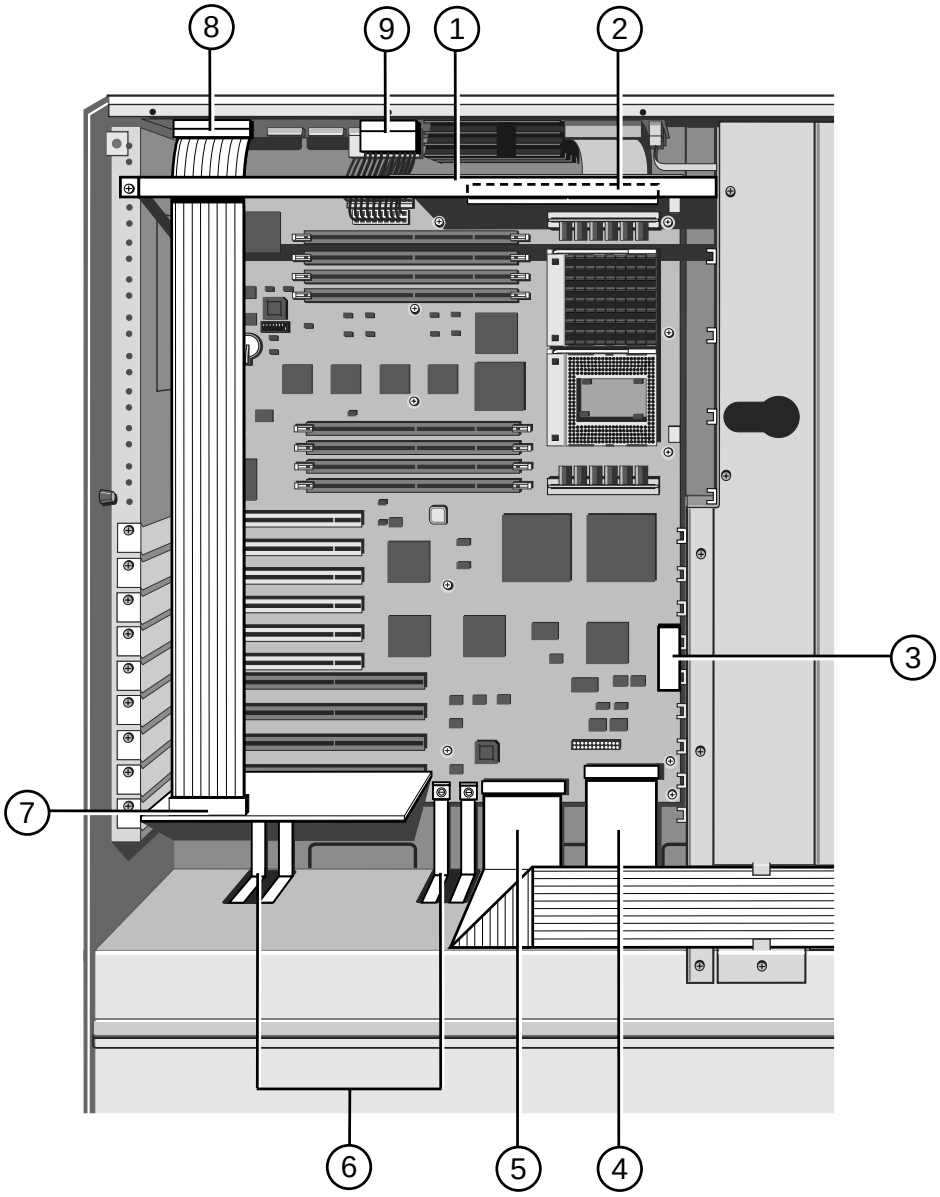


Figure 8-2 Motherboard in situ

1	Support/retaining strut	6	Busbars to Power supply
2	Termination/extra CPU card	7	SMIC card (bottom slot)
3	Aux. power connection	8	SMIC cable to power board
4	Hard Disk SCSI Cable	9	Power board connections
5	Removable. media SCSI cable		

4. Remove six screws from the periphery of the subplate which surrounds the serial, parallel and video connectors on the back panel of the server.

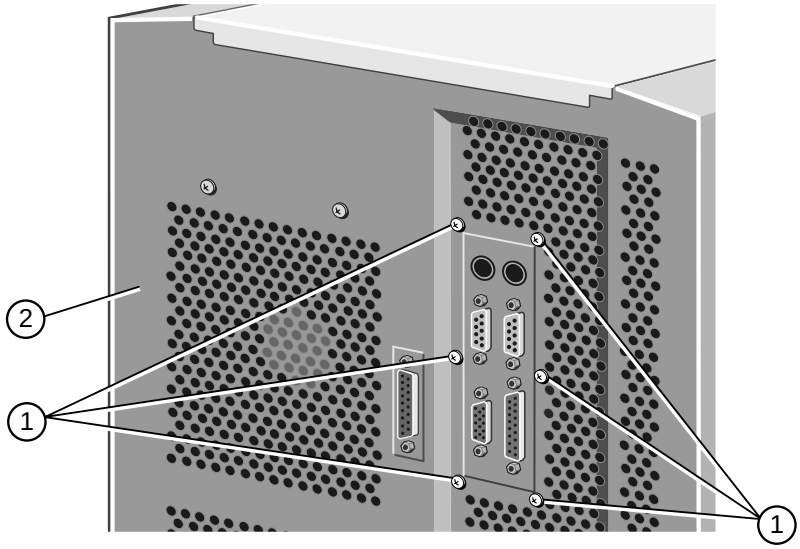


Figure 8-3 Rear subplate screws

1	Fixing screws	2	system rear panel

5. Now remove the System Management Interface Card (SMIC). Unplug its ribbon cable, which is attached to the distribution board at the top of the electronics chamber, using the ejector latches fitted to the sockets.

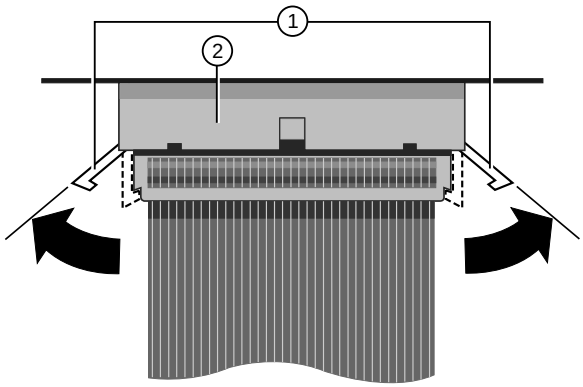


Figure 8-4 SMIC cable release.

1	Cable retaining latches	2	Ribbon cable socket

6. Remove the termination board, or, if fitted, the metal strut which supports the additional CPU card. There is a single screw on one end of the strut with a hook on the other. Then remove the CPU card.

7. Remove and put in a safe place, any fitted expansion boards.

Caution

All boards and assemblies should be placed on an antistatic surface or within an antistatic container as they are removed from the server.

8. Unplug the DC power connectors. One from the power distribution panel at the top of the electronics chamber, then the other from the lower right hand side (direct from the PSU).

9. Unplug the data ribbon that connects to the power distribution panel. Again, use the ejector latches.

10. Unplug the Floppy Drive connector.

11. Unplug the two SCSI interface cables from the connectors at the bottom of the motherboard.

12. Using an M5 socket, release the busbar connections at the base of the motherboard.

13. Now remove **21** screws which secure the board to the centre spine of the server, as shown:

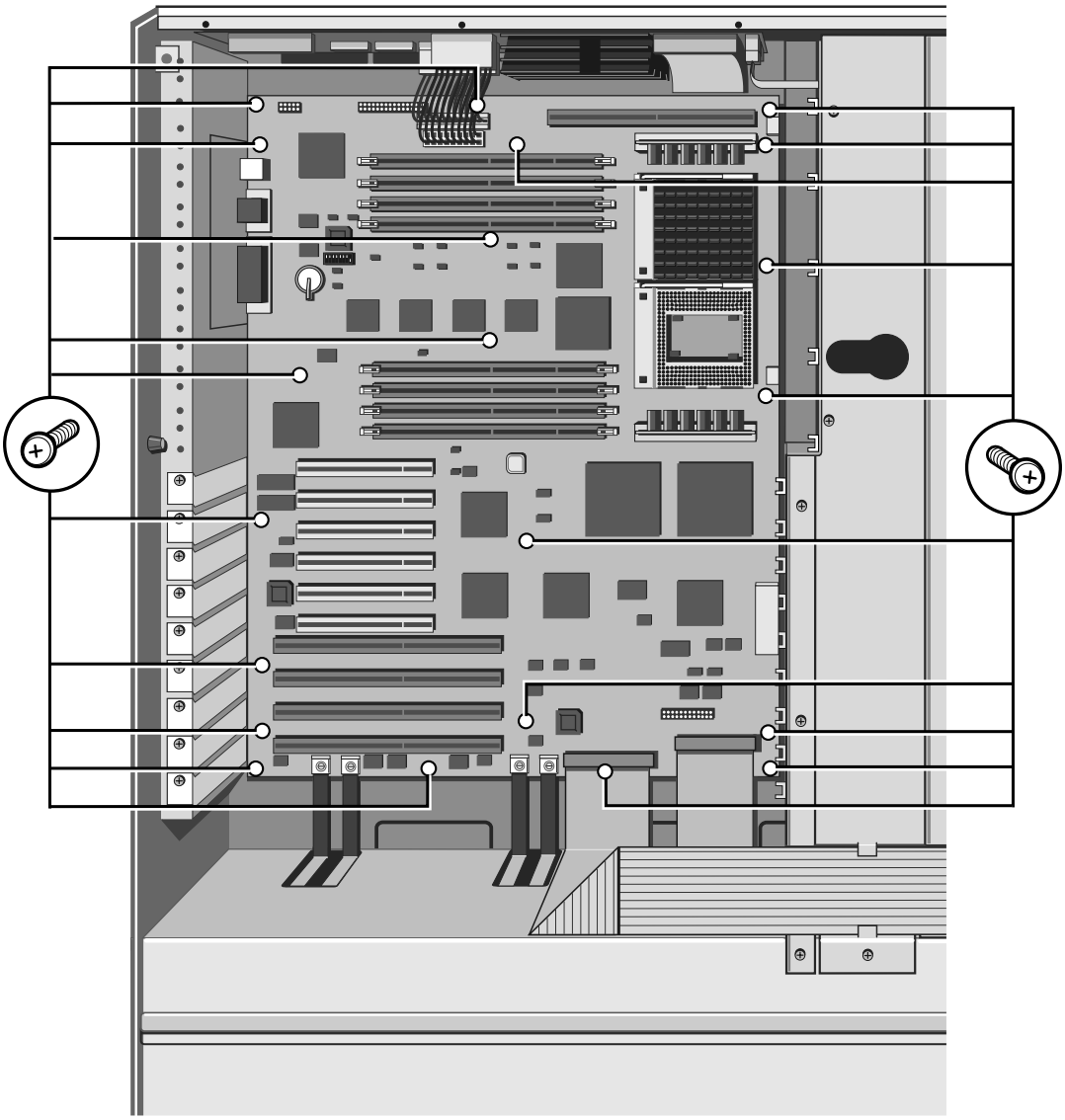


Figure 8-5 Motherboard Securing Screws

Caution

When refitting the motherboard, due to the very high operating frequencies of modern systems, it is extremely important that all of the mounting screws are refitted to ensure effective grounding to the server metalwork over the whole board area.

Lift the motherboard gently off the support lug at the top right corner in the electronics chamber and place on a suitable antistatic surface.

Ports sub-plate

If the motherboard is being replaced, the metal sub-plate supporting and identifying the rear ports *must be removed to be fitted to the new motherboard.*

Carefully remove the port fixing screwlocks and lift the plate clear.

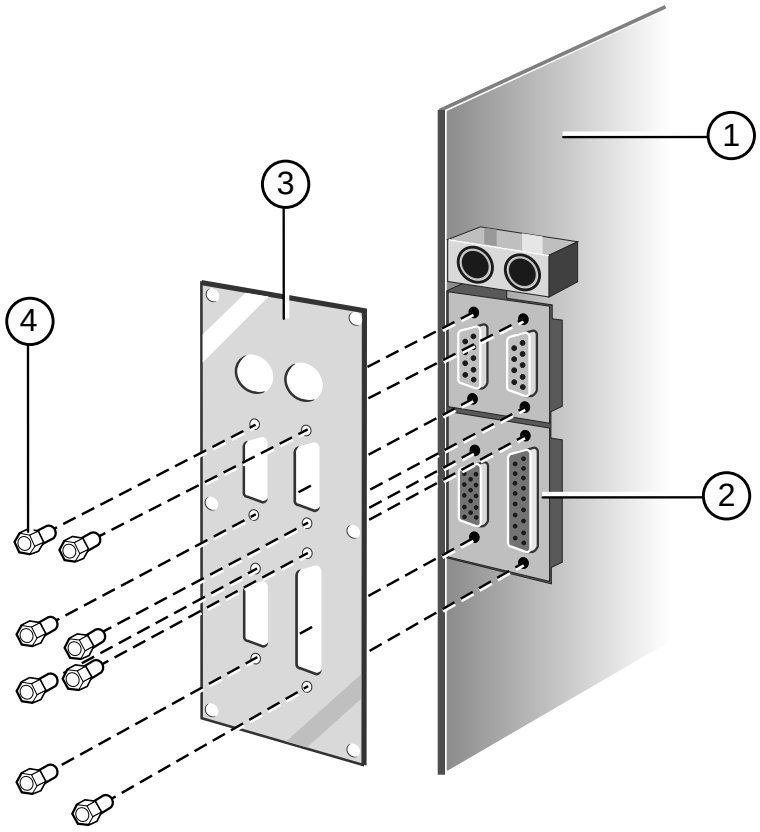


Figure 8-6 Rear sub-plate assembly

1	Top right corner of motherboard	3	Ports sub-plate
2	Ports on motherboard	4	Port mounting screwlocks

Fitting the Motherboard

1. Replace the six screws which secure the connector sub-plate, on the back panel, to the server chassis.
2. Attach the motherboard to the centre spine of the server using the **21** screws as shown in the following illustration:

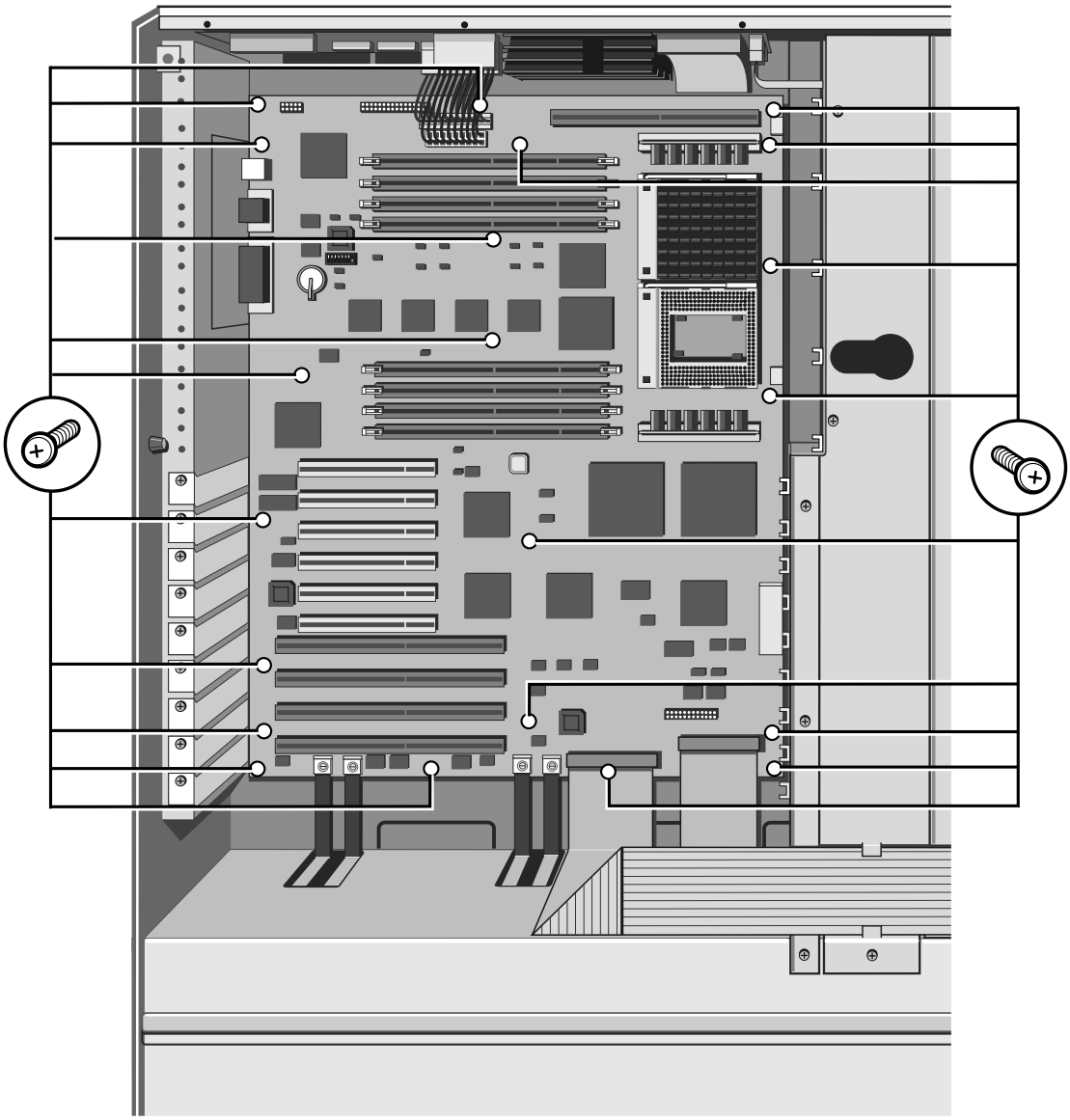


Figure 8-7 Motherboard Securing Screws

4. Reconnect the hard disk cable from the drive module to the appropriate connector as it was originally.

Caution

It is vital that you remember the exact cable and connector arrangement of your hard disks, particularly if you are using a RAID (Redundant Array of Independent Disks) configuration. If you fail to restore the arrangement so that all cables and plugs are as they were originally, you risk losing all the data on your hard disks.

5. Plug the Floppy Drive and Front Panel cables into their respective connectors.
6. Plug the DC power cables into their respective connectors on the power distribution board at the top of the electronics chamber. These connectors are keyed and cannot be plugged incorrectly. Do **not** use force; you may be trying to plug a cable into the wrong connector.

7. Replace the bus termination board or the additional CPU card (plus its support strut).
8. Replace any expansion cards and their appropriate ribbon cables.
9. Replace the SMIC card in the lowest EISA slot and plug its cable into the power distribution board at the top of the electronics chamber. Ensure the plug is firmly fixed into the socket using the latches.

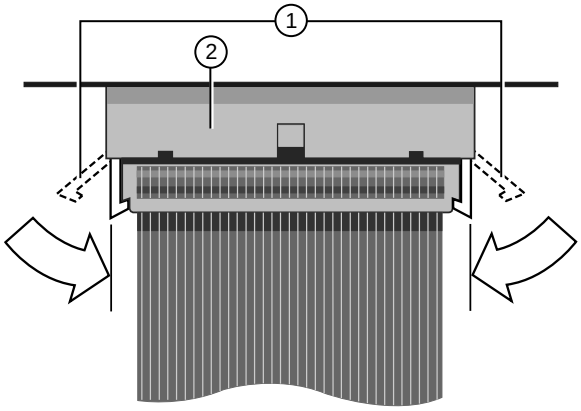


Figure 8-8 SMIC cable latch.

1	Cable retaining latches	2	Ribbon cable socket

10. Using a torque wrench set to 5 Nm, connect up and tighten the busbar connections at the base of the motherboard.
11. Refit the auxiliary power supply cable to the lower right hand side power connector.
12. Ensure all the processors and memory modules are refitted correctly.
13. Hook the left edge of the protective metal plate in place and secure the plate to the server chassis using the screws along the top and right edges.
14. Reconnect all cables and leads to the back panel port connectors.

Note

You must always refit all protective metal plates. These plates, in addition to providing protection for delicate components, contribute to an effective flow of cool air through the machine.

Motherboard Power Distribution Panel

The motherboard power distribution panel fixed to the inner roof of the electronics chamber and is positioned at right angles to the motherboard. The following illustration shows the connectors and the eight securing screws on the board:

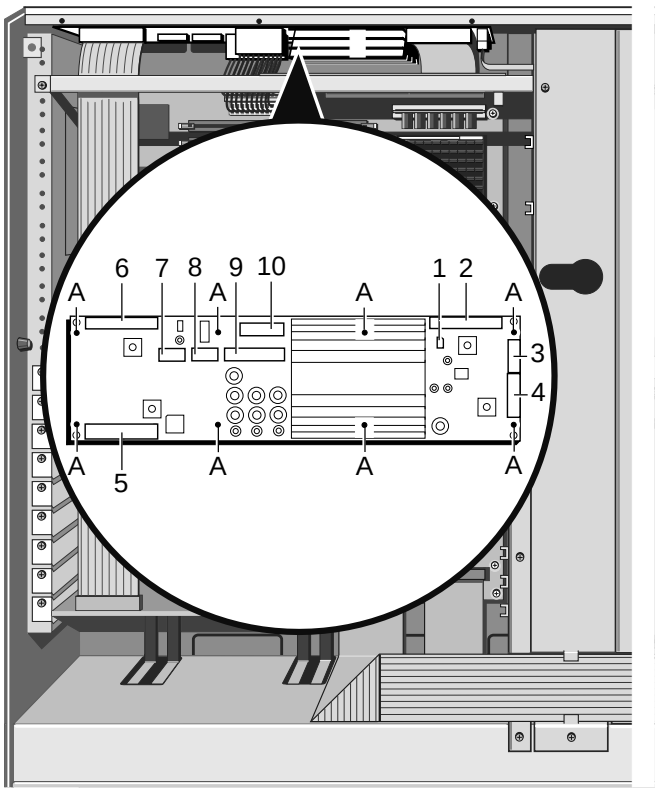


Figure 8-9 Motherboard Power Distribution Panel

A	Securing Screws (x8)		
1	Loudspeaker Connector	6	SMIC Card Connector
2	Motherboard connector	7	Power from motherboard
3	Fan Board Connector	8	Power from motherboard
4	Aux. power connector	9	Power to/from motherboard
5	SMC connection	10	3.3 v supply to motherboard

Removing

1. Unplug all connectors on the panel, noting their position.

Note

You may have to remove the termination/additional CPU card to provide enough working space to complete this procedure.

2. Remove eight securing screws and remove the panel.

Fitting

1. Fasten the panel to the inner roof of the electronics chamber with the 8 screws.
2. Plug the various connectors into the board. Each connector is keyed so that it cannot be plugged into the wrong socket.

9 POWER BOARDS AND SPEAKER

There are two separate power distribution panels, one for hard disk drives and one for Removable Media drives.

Warning

Read completely the instructions detailed in chapter 3 at the beginning of the service section.

Hard Disk Drive Power Distribution Panel

Removing

1. Remove the motherboard cooling fan assembly as detailed in chapter 8.
2. This uncovers three bus bars which are attached to the power distribution panel, through a cut-out in the centre spine, and to the power supply, as shown in the following illustration:

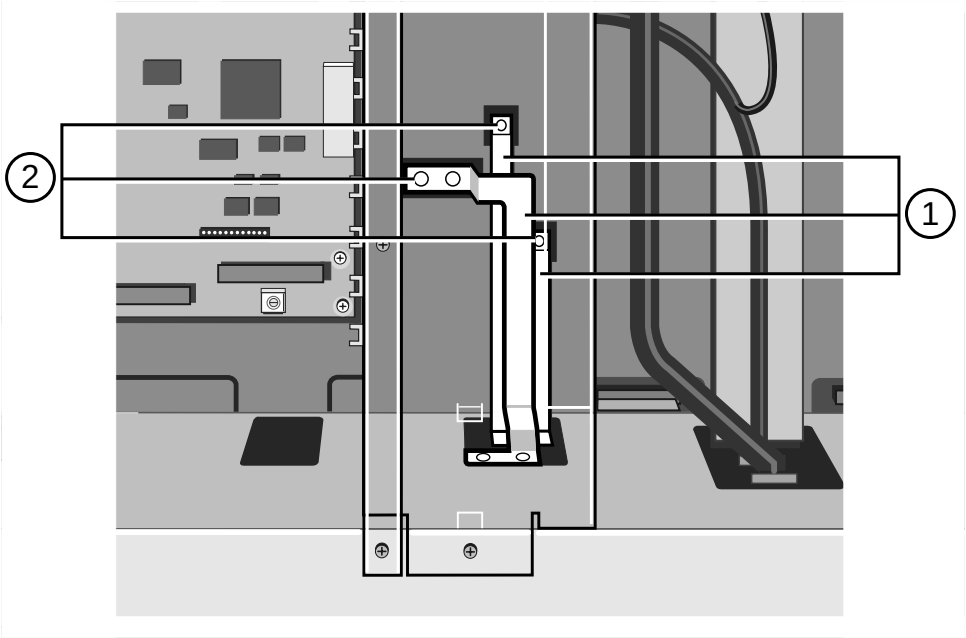


Figure 9-1 Bus Bars Connected to Hard Disk Power Distribution Panel

1	Bus Bars	2	Connections to Hard Disk Power Distribution Panel

3. Detach the three bus bars from the distribution panel.
4. In the disk chamber, remove all hard disk drives and drive modules.
   ◊ Also, remove any blanking plates that cover empty disk chamber space.
5. Remove 11 screws as shown in the following diagram and lift out the panel.

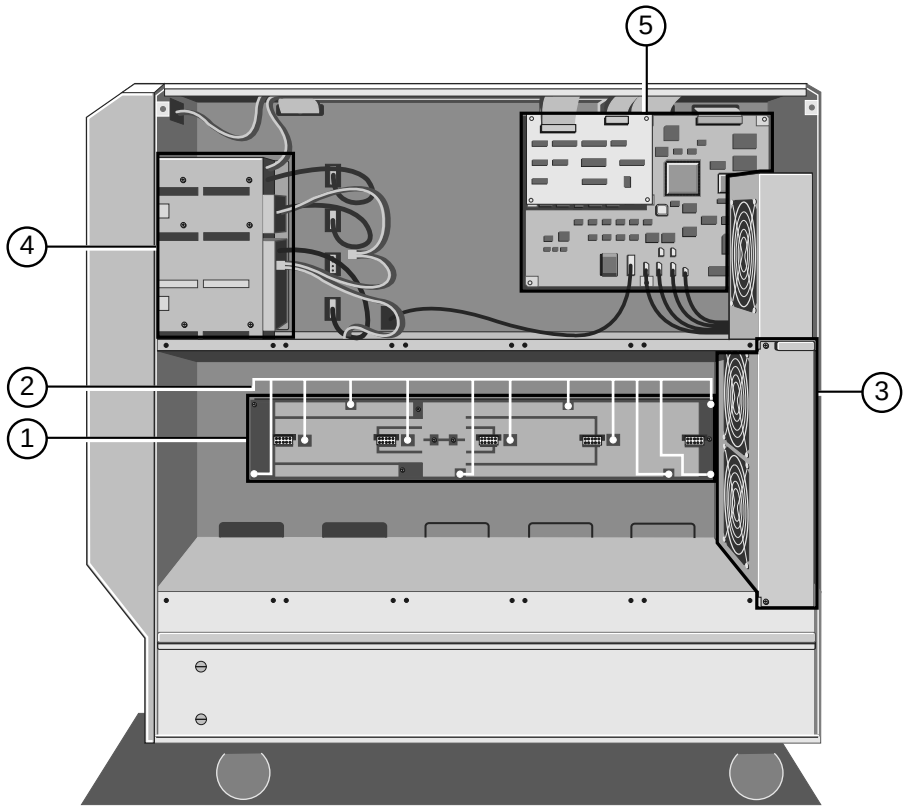


Figure 9-2 Hard Disk Power Distribution Board

1	Power Distribution Panel	4	Removable Media Drives
2	Securing Screws	5	SMC Board
3	HD Cooling Fan Assembly		

Fitting

1. With all hard disk drives, drive modules and the motherboard cooling fan assembly removed, attach the hard disk distribution board to the centre spine of the server, in the disk chamber, using the 11 screws as shown above.
2. Refit all the hard disk drive modules and drives.

Caution

It is vital that you remember the exact cable and connector arrangement of your hard disks, particularly if you are using a RAID (Redundant Array of Independent Disks) configuration. If you fail to restore the arrangement so that all cables, plugs and disks are as they were originally, you risk losing all the data on your hard disks.

3. Reconnect the bus bars in the electronics chamber.

Note

You must use a torque wrench to tighten the bus bar bolts. The torque wrench setting is 5 Newton metres (Nm).

4. Replace the motherboard cooling fan assembly.
5. Replace all panels and blanking plates to ensure correct airflow through the system.

Removable Media Drive Bay Power Distribution Panel

Removing

1. In the electronics chamber, unplug two power cables as shown in the following diagram:

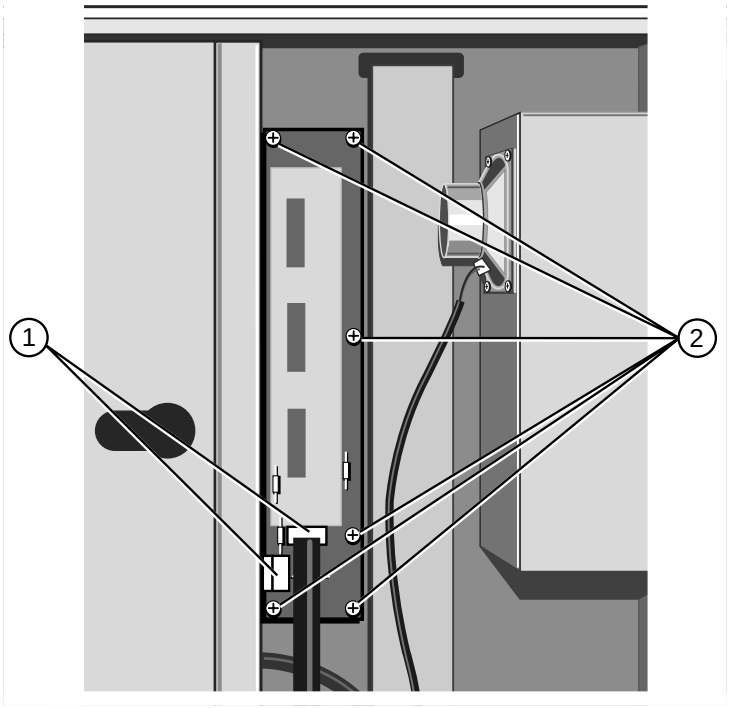


Figure 9-3 Removable Drive Bay Power Distribution Panel

1	Cable Connectors	2	Securing Screws

2. In the disk chamber, unplug the cables which provide power to the removable media drives.
3. Now remove the six screws which fasten the power distribution board to the centre spine and remove the board, as shown in the previous diagram.

Fitting

1. Fasten the power distribution panel onto the centre spine of the server with the six screws as shown above.
2. Connect the two power cables as shown in the previous illustration.
3. In the disk chamber, reconnect the cables which provide power to the removable media drives.

Loudspeaker

Removing

1. Remove the motherboard cooling fan assembly as previously detailed.
2. Unplug the loudspeaker cable from the connector on the motherboard power distribution panel, as shown:

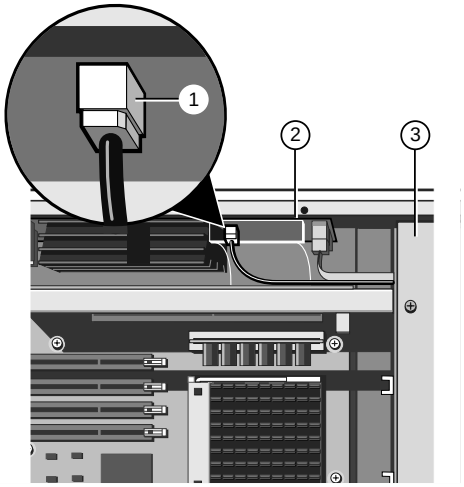


Figure 9-4 Loudspeaker Connector

1	Loudspeaker Connector	3	Cooling Fan Assembly
2	Power Distribution Panel		

3. Remove the four screws which fasten the loudspeaker onto the front drive bay door housing, as shown:

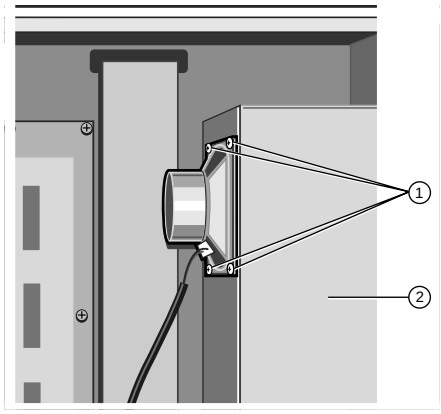


Figure 9-5 Loudspeaker

1	Loudspeaker Securing Screws	2	Removable Media Drive Bay

Fitting

1. Use the four screws to attach the loudspeaker to the front drive bay door housing, as shown above.
2. Plug the cable into the loudspeaker connector on the motherboard power distribution panel.
3. Refit the motherboard cooling fan assembly.

10 POWER SUPPLIES AND OPTIONAL BATTERY BACKUP UNIT (BBU)

Warning

Read completely the instructions detailed in chapter 3 at the beginning of the service section.

Module Power output

The power section is, in total, rated at: (output of 3 modules at 267W per module)

- +5V rail at 81A
- +12V rail at 33A
- -5V rail at 500mA
- -12V rail at 500mA
- 5V standby rail at 800mA

The above ratings are for three power modules, the fourth being a 'redundant' module.

The first two are for the busbars for the motherboard and the hard drive power board, the rest are taken via the multiway cables to their various destinations. Adding hard drives, extra processors or multiple expansion cards may require the addition of further power modules, contact your Apricot supplier for details.

Preliminary task

Before you begin, ensure that the server is in a suitable area with plenty of work space. Then, use the jacking mechanism in the front castors to anchor them firmly to the floor so that the server cannot roll about.

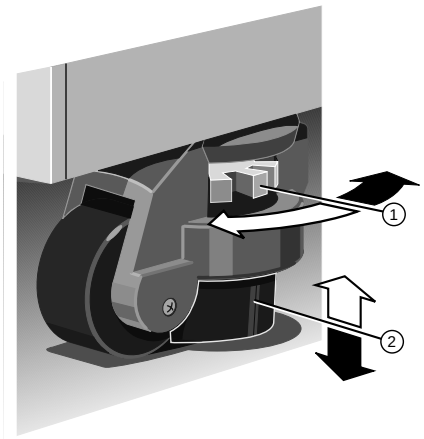


Figure 10-1 Front Castor Adjustment

1	Adjustment Wheel	2	Jacking Pad

Removing and fitting power modules

The power tray will be fitted with at least one power module, or up to a maximum of four.

Depending on the system configuration and the number of working modules fitted, one power module may be removed without shutting down the whole system, providing the

remaining power modules can cope with the system load. See above for power module rating information.

It is advisable, if unsure, to fit a spare unit first if the computer cannot be shut down. The modules can be hot-swapped. *If in any doubt, follow the instructions in chapter 3 and shut down the system.*

Any failed unit will display a red LED on its rear plate, or be completely unlit, while healthy units display a green LED. The modules are easily removed and fitted.

To remove a module

1. Loosen the floating fasteners, located at the top and bottom of the module to be removed, until they move in and out freely.
   - ◊ These fasteners are mounted in a spring fitting and should not be separated from the module.
2. Gently but firmly pull on the handle until the module slides out. There will be some resistance from the rear socket.

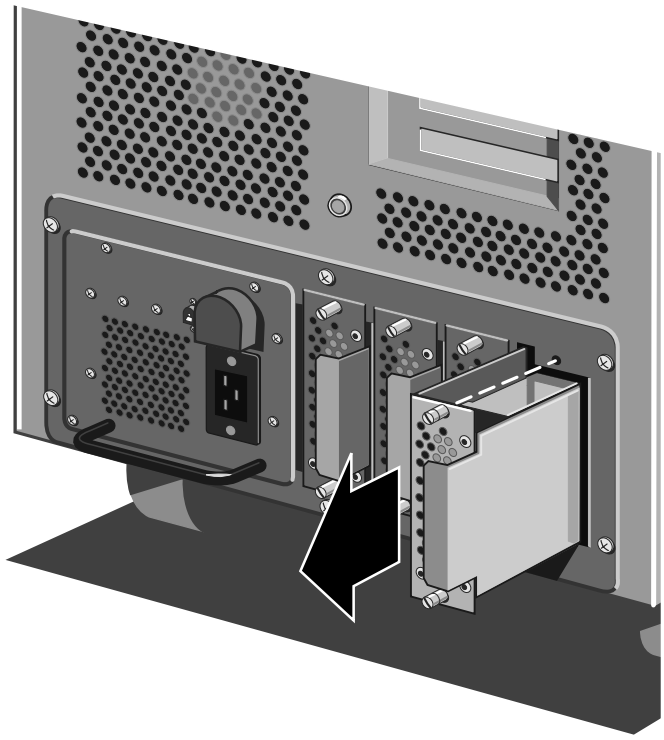


Figure 10-2 Power Module removal and refitting

To fit a module

1. Carefully slide the module into the internal guide rails and press firmly into the rear socket.
2. Fix into position with the retaining fasteners. Do not overtighten.

If the module is being fitted to a live system, the red LED will initially show during the unit's self test. Then the green LED will come on to indicate the module is working correctly. If the computer has been powered down, all modules will briefly show red LEDs on power-up.

Removing the complete Power Tray

Warning

There are very few circumstances that would require the removal of the Power Tray, but details are given here for completeness. It is recommended that work on the tray should only be undertaken by a service engineer, with someone to assist, as the tray is very heavy.

1. It is **vitally** important to ensure that the system is correctly shut down. If a BBU is fitted, the battery link must be removed and the system disconnected from the mains electricity supply.
2. Remove the motherboard cooling fan assembly as detailed in chapter 8.
3. First detach two pairs of motherboard busbars and then the set of 3 busbars under the cooling fan assembly as shown in the following diagram.

   ◊ If necessary, remove some of the expansion cards to improve access to the busbars. You may also need to unplug some of the data cables which are connected to the hard disk drive modules.

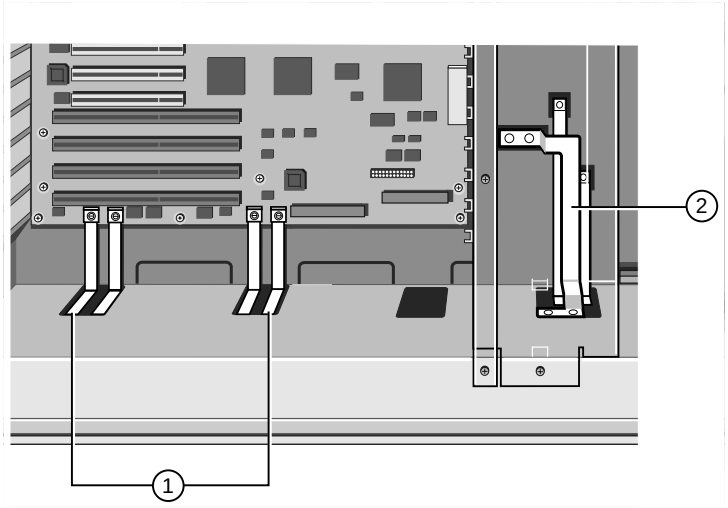


Figure 10-3 Busbars

1	Motherboard Busbars	2	Busbars for Hard Disk Power Distribution Panel

Caution

It is vital that you remember the exact cable and connector arrangement of your hard disks, particularly if you are using a RAID (Redundant Array of Independent Disks) configuration. If you fail to restore the arrangement so that all cables, plugs and hard disks are as they were originally, you risk losing all the data on your hard disks.

5. Make sure that there is enough clearance between the busbars and their power supply connections to allow the unit to slide freely, you may need to remove the busbars completely.
6. Unplug three cables from the power supply as shown over.

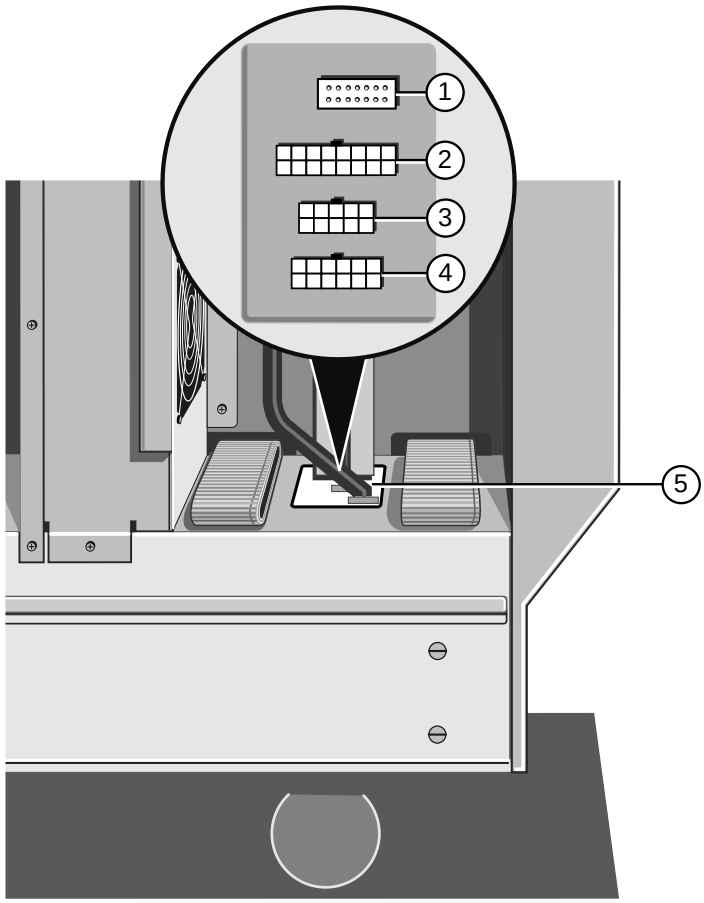


Figure 10-4 Disconnecting Power Supply Cables

1	System Controller Connector (Ribbon)	4	Removable Media Bay Connector (12-way)
2	Motherboard Auxiliary Power (16-way)	5	Cable Connector Group
3.	Not used		

7. Loosen four floating fasteners, two on each side of the server, until they are free of the power supply unit, as indicated in the next illustration.

Warning

This Power supply is heavy. It is strongly advised to have a second person to assist before either fully removing the assembly from the server, or picking it up to fit it back into the server.

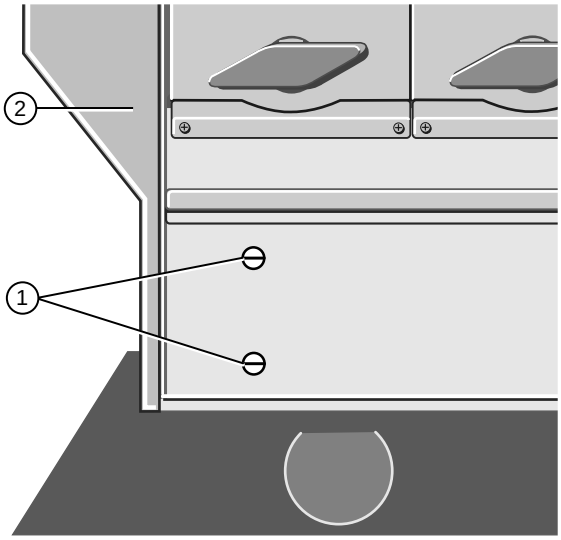


Figure 10-5 Power Supply Floating Fasteners

1	Floating Fasteners	2	Front Bezel

8. Now remove six screws on the back panel of the server, as shown:

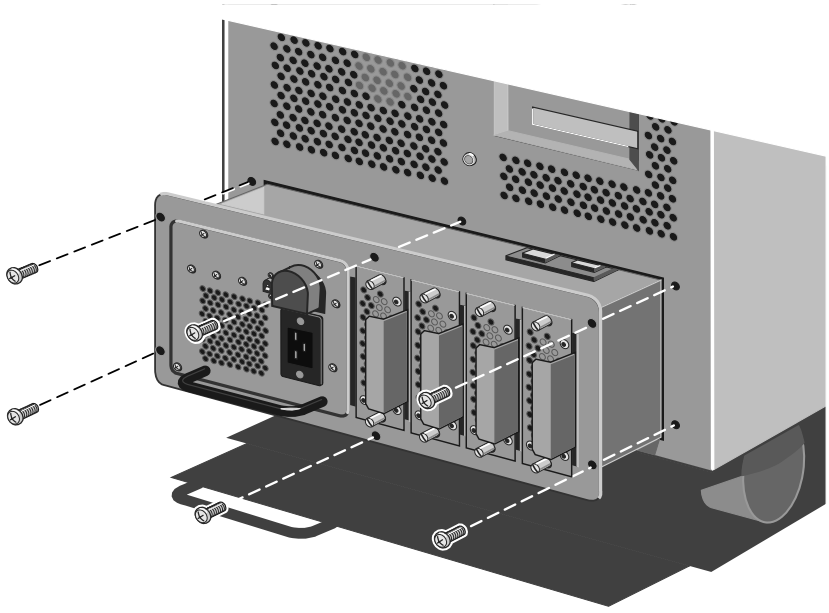


Figure 10-6 Power tray Securing Screws

9. Using one or two of the handles, pull the unit **carefully** forward about 8 to 10cm, until a set of concealed busbar bolts become visible through one of the motherboard chamber busbar windows. Remove these bolts.

10. Continue pulling, this time using the main PSU flange, until it is a little less than halfway out (about 30 cm), just before it begins to tip towards you.

11. The second person should assist, on the opposite side of the unit, from this point onwards.

12. Place your hands under the metal casing of the unit as indicated by the arrows in the following illustration:

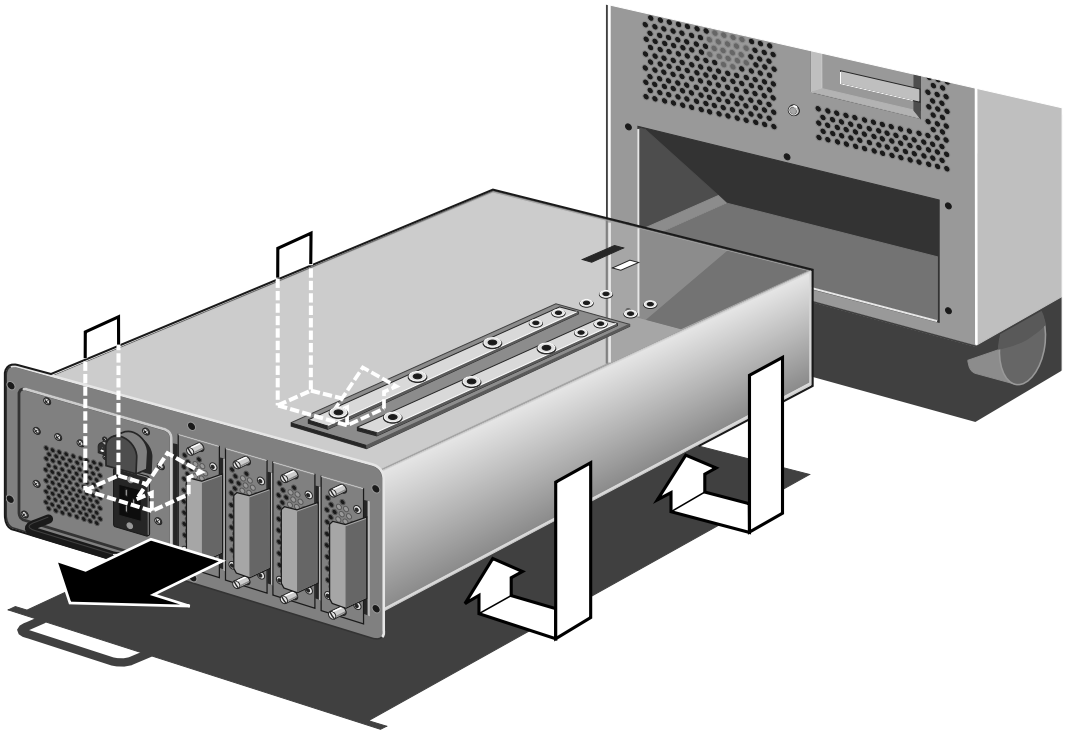


Figure 10-7 Power tray Removal

13. Slide the unit out **slowly** until it is free from its housing. Now rest the unit on the floor or a suitable workbench. Do not drop it.

Fitting

1. With the help of the second person on the opposite side, place your hands underneath the power supply as indicated by the arrows in the illustration above.
2. Now carefully slide the unit almost all the way into the chassis.
3. Use the front motherboard chamber busbar window to fix the bolts that hold the power distribution board to the output connections of the power tray. Then slide the tray fully in.

Caution

The hardware used to hold the busbar connections must be tightened using a torque wrench set to 5 Newton meters (Nm).

4. Secure the unit to the chassis with the six screws as shown in *Figure 10-6*.
5. Now tighten the four floating fasteners, two on each side, located towards the front of the machine as shown in *Figure 10-5*.
6. Plug the cables into their connectors on the power supply as shown in *Figure 10-4*.
   - ◊ Note that these connectors are keyed and can only be fitted in one position.
7. Attach the set of 3 busbars to the HDD power board as shown in *Figure 10-3*. Then attach the two pairs of busbars to the motherboard.
   - ◊ As with the cables, it should not be possible to fit these bars incorrectly.

8. Fit the motherboard cooling fan assembly.
9. Refit any expansion cards you may have removed to improve access.

Caution

It is vital that you remember the exact cable and connector arrangement of your hard disks, particularly if you are using a RAID (Redundant Array of Independent Disks) configuration. If you fail to restore the arrangement so that all cables, plugs and hard disks are as they were originally, you risk losing all the data on your hard disks.

Optional Battery backup unit (BBU)

Warning

The power supply tray can be equipped with an optional BBU. Although it is a replaceable unit, (information on removal and refitting is given below) it MUST ONLY BE FITTED, OR REMOVED, BY A SUITABLY QUALIFIED SERVICE ENGINEER.

Initial installation of the unit MUST only be carried out by a service engineer visit to correctly setup the system to accommodate a BBU. Contact your Apricot supplier for details.

Initial installation

ONLY BE UNDERTAKEN BY A SERVICE ENGINEER.

1. Shut down the system and disconnect from the supply.
2. Remove the blanking plate but retain the fixing screws.
3. Reach inside the BBU space and detach the small printed circuit board from the clip-in mounting (this may be easier with a long screwdriver, due to limited space).
4. Disconnect the wiring harness from the rear BBU edge connector and remove the assembly from the chassis completely.
5. Fit the BBU into the power tray as detailed on the following page.

Important - Warning

The battery pack contains lead acid batteries. In the EEC the directive 91/157/EEC (plus subsequent amendment 93/86/EEC) designates batteries containing lead to be handled as a dangerous substance.

Similar regulations will apply in other countries.

The battery pack must only be removed by a qualified electrician and must not be disposed of in domestic waste.

Removing

1. Ensure the system is shut down as detailed in chapter 3.
   - ◊ Ensure that you remove the BBU isolation link.
2. Remove the fastening screws as shown in the following diagram:

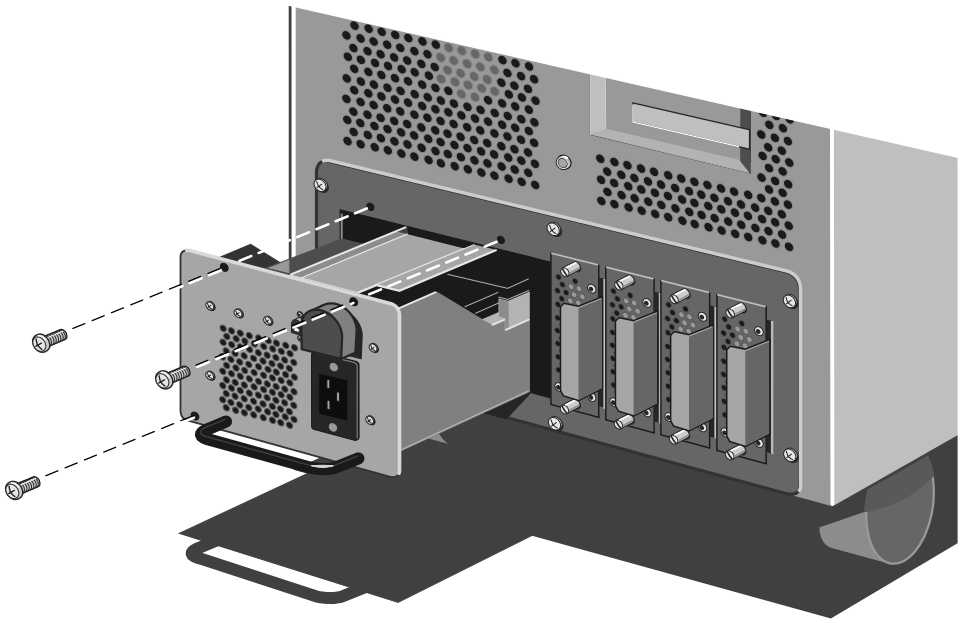


Figure 10-8 Battery Backup Unit

2. Pull the BBU handle carefully. There will be initial resistance due to the power connector at the rear. Slide the unit out **slowly** . It is heavy.
3. Now with a slight lift, you can remove the BBU clear. Place it only on a clear flat surface.

Warning

The BBU even when withdrawn may still contain a high charge. Handle with extreme care.

Fitting

1. Carefully lift the BBU into position and slide it slowly into the chassis.
2. Push the unit the rest of the way into the chassis.
3. Press firmly into the socket.
4. Refit the retaining screws as shown in the above *Figure 10-8*.
5. Fit the BBU isolation link.

Battery Isolation (Fireman's Switch)

The BBU link can be used to connect to the Building Fire Services power isolation and safety mechanisms if required. This is a common for big buildings or businesses having telephone exchanges and air conditioning etc., but often overlooked within large computer installations and networks.

The BBU isolation link is essentially a mini-plug, complete with cable grip, having the two small pins internally connected. This connection can be broken and the terminals wired to external cabling.

Screened cable should be used to connect to the isolation switch or power panel relay, which should have a normally closed (healthy) contact. For further information contact either your supplier, or Apricot Computers Limited, Technical Support department.

11 TECHNICAL INFORMATION OVERVIEW

This section contains technical information about your Apricot computer under the following topics:

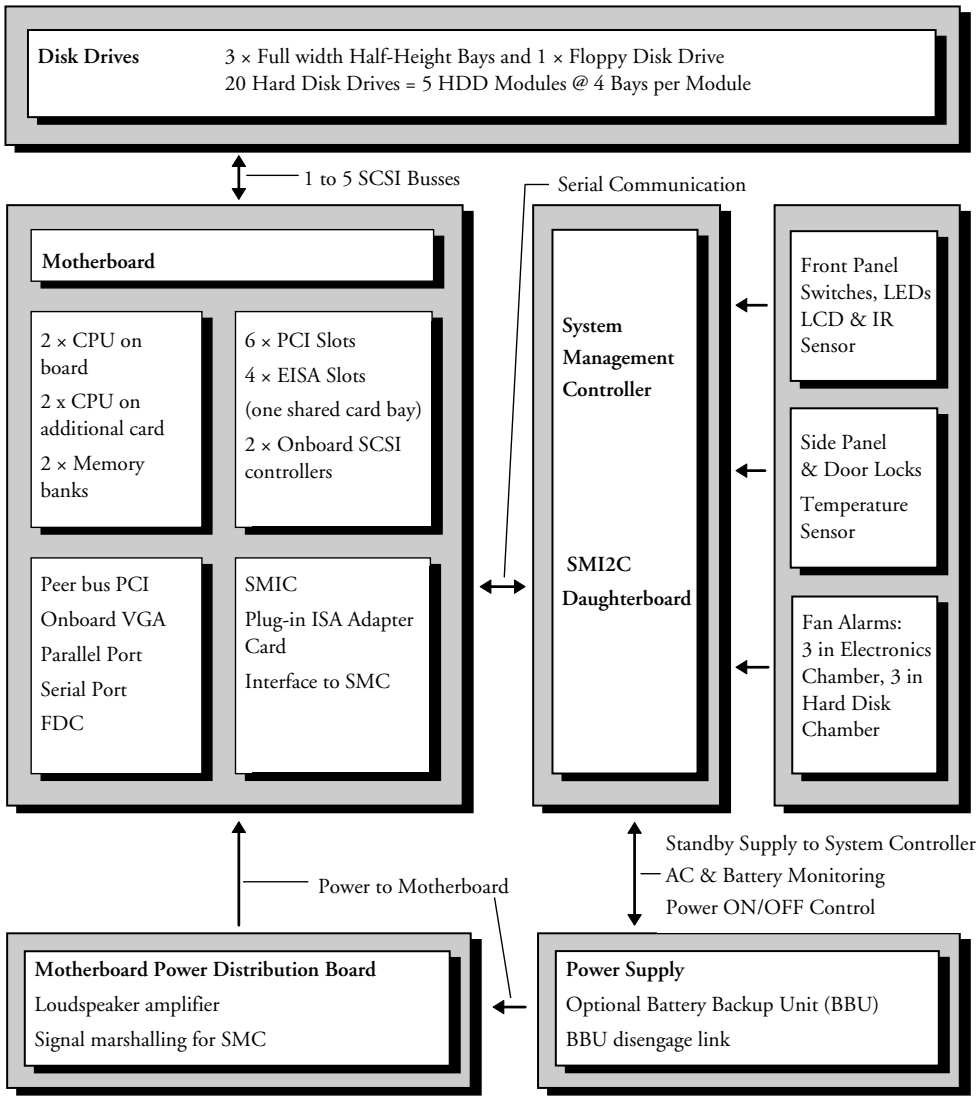
Topics covered	Chapter
Section layout Functional Architecture Memory Central Processing Unit	11
Motherboard Switches and Jumpers I/O Connectors and Headers	12
System Management Interface Card (SMIC) System Management Controller	13
Power Distribution Boards Power Supply and optional BBU	14
Diagnostic Codes and Fault Messages	15
Antistatic precautions	Appendix

Functional Architecture

Your server's functional divisions consist of the following:

- Motherboard
- System Management Controller
- Front Panel
- Power Supply
- Optional battery back up unit (BBU)
- Hard Disk Drives and Removable Media Drives
- Motherboard Power Distribution Board

The following block diagram indicates the relationship of these divisions to each other:



Description

The architecture of your server supports symmetrical multiprocessing (SMP) and a variety of operating systems. The server is equipped with both PCI (Peripheral Component Interconnect) and EISA (Extended Industry Standard Architecture) busses. The standard removable media bays can house a variety of storage devices, such as tape backup or CD-ROM. One floppy drive is standard to every server.

The System Management Controller (SMC) monitors your system and reports problems. The methods that the SMC uses to communicate the status of the system are as follows:

- Hexadecimal codes sent to the Front Panel liquid crystal display (LCD)
- Audible beep codes and alarms

Detailed information is available in the System Management Application (SMA), a Windows software program specially designed for the server. This application, which you can run on another computer remotely (via modem, serial, or network link), alerts you if there are problems such as component failure, overheating, security breaches and power failures.

The SMC communicates with the motherboard by means of the System Management Interface Card which occupies the lowest EISA slot.

The power supply can house the basic minimum of one or the maximum of four modules. They can be hot-swapped. Each module can supply up to 267W to the computer (see chapter 10 for further infomation).

In addition, the power tray can be fitted with an optional battery back up unit (BBU) so that the power supplies can act as an uninterruptible power supply (UPS). This requires a service engineer to correctly fit and set up. Contact your Apricot dealer for information.

General

Dimensions

Height	Including castors	750 mm.
	Excluding castors	670 mm.
Length		790 mm.
Width		410 mm.
Weight	Max (with 20 drives)	115Kg.
	Incl. packing	140Kg.

Temperature

Operating		0° to 40°C
	(If BBU fitted)	Max 35°C
Storage	(In suitable packaging)	-40°C to 70°C
Airflow		200 CFU

A gap of at least 15 cm must be allowed clear around the server to allow for adequate air circulation.

Power

Supply Voltage	Min to Max.	85 to 253V AC
Frequency	Min to Max.	47 to 63 Hz

Memory

Server memory is located in two memory slot areas on the motherboard. Fully loaded, these provide 2 Gbytes of common high-speed memory for the server. Each group can hold 1,2, or 4 ECC Dual In-line Memory modules (DIMMs.) All DIMMs in a bank must be the same. There are advantages in fitting two or four DIMMs into any bank as two way and four way interleave become available. Full details of the memory population rules can be found with other relevant information in chapter 2.

Interleave scheme

Interleave	*BANK ONE*	*BANK TWO*
1 way	Socket **2**	Socket **1**
2 way	Socket **2+4**	Socket **1+3**
4 way	Socket **2+4+6+8**	Socket **1+3+5+7**

Read perfomance

No. of DIMMs in a bank	*Interleave*	*Page miss +Precharge*	*Page miss*	*Page hit*	*Page hit burst data rate*
four	4 : 1	14:1:1:1	11:1:1:1	8:1:1:1	194 Mb/s
two	2 : 1	14:2:2:2	11:2:2:2	8:2:2:2	152 Mb/s
one	1 : 1	14:4:4:4	11:4:4:4	8:4:4:4	107 Mb/s

The above is based upon 60ns DRAM and a system clock of 66 Mhz.

Write performance

No. of DIMMs in a bank	*Interleave*	*Page miss +precharge*	*Page miss*	*Page hit*
four	4 : 1	10	7	7
two	2 : 1	11	8	8
one	1 : 1	16	13	13

The above is to memory of complete cache line.

Full details of the type of memory modules supported can be found in section 1, chapter 2, which deals with memory upgrades and other related topics.

The ECC function detects and corrects single-bit errors from DRAM (Dynamic Random Access Memory) in real time, allowing your system to function normally. It detects all double-bit errors but does not correct all of them, it also detects all three-bit and four-bit adjacent errors in a DRAM nibble but does not correct them. When one of these uncorrected errors occurs, the ECC memory card generates an NMI (NonMaskable Interrupt) and usually halts the system.

The server supports both base (conventional) and extended memory. Base memory is located at addresses 00000h to 9FFFFh (the first 640 Kbytes). Extended memory begins at address 100000h (1 Mbyte) and extends to the limit of addressable memory (2 Gbytes).

Some operating systems and application programs use base memory, e.g. MS-DOS, OS/2, and UNIX. Other operating systems use both conventional and extended memory, e.g. Windows and Windows NT. MS-DOS does not use extended memory, however, some MS-DOS utility programs such as RAM disks, disk caches, print spoolers etc., use extended memory for better performance.

Memory Map

Address Range (hex)	*Amount*	*Function*
0000,0000 – 0003,FFFF	256 KB	Base system memory (fixed)
0004,0000 – 0007,FFFF	256 KB	Base system memory (fixed)
0008,0000 – 0009,FFFF	128 KB	Base system memory or ISA memory enabled in Setup
000A,0000 – 000B,FFFF	128 KB	ISA video DRAM
000C,0000 – 000E,FFFF	192 KB	Off board video BIOS (can be shadowed) AIC-7870 SCSI BIOS (can be shadowed)
000F,0000 – 000F,FFFF	64 KB	ISA memory, system BIOS (fixed)
0010,0000 – 00EF,FFFF	14 MB	System memory or unused
00F0,0000 – 00FF,FFFF	1 MB	System memory or EISA/ISA memory
0100,0000 – 3FFF,FFFF	1008 MB	System memory or unused
4000,0000 – BFFF,FFFF	1024 MB	EISA memory or I/O slave memory
C000,0000 – C1FF,FFFF	32 MB	Memory mapped math coprocessor
C200,0000 – FEBF,FFFF	944 MB	EISA memory or I/O slave memory
FEC0,0000 – FEC0,0FFF	4 KB	I/O APIC #1
FEC0,1000 – FEC0,1FFF	4 KB	I/O APIC #2
FEC0,2000 – FEC0,2FFF	4 KB	I/O APIC #3
FEC0,3000 – FEC0,3FFF	4 KB	I/O APIC #4
FEC0,4000 – FFDF,4FFF	32752 KB	EISA memory or I/O slave memory
FFE0,0000 – FFFF,FFFF	32 KB	EISA (BIOS/ECU)

Central Processing Unit

The server's first two CPUs are located on the motherboard. The motherboard has two type 8 ZIF sockets to become either a single or a dual processor board. There is a further additional card which can hold two more identical processors that can be fitted into a socket at the top of the motherboard. If this board is not fitted there is a termination board in its place. All four processors must be the same.

The system provides a high-performance symmetric multiprocessing (SMP) environment. In SMP, all processors are equal and have no preassigned tasks. Distributing the processing loads between more than one processor increases system performance. This is particularly useful when application demand is low and the I/O request load is high. In the SMP environment, processors share the same interrupt structure and access to common memory and I/O channels.

Each processor contains its own internal L2 cache memory.

The processor power-up configuration logic provides the motherboard BIOS with information about its CPU speed, the presence of numeric coprocessor, cache size, cache line size and snooping policy.

Features

- One to four Pentium Pro processors with bus/core speed ratios enabling upgradable operation.
- Compatible Intel proprietary bus interface providing support for:
  - 64-bit data bus
  - Bus level symmetrical multiprocessing
  - Back-off to allow concurrency in system
- Address and data bus parity
- Data path control allowing pipelining of read and write data through a separate data path ASIC

Power supply

The power tray is designed to take up to four power supply modules. Each module can provide up to 267W to the system (see chapter 10 for further information). The basic configuration is one module. They can be hot-swapped, providing that the remaining modules can cope with the complete system load.

Any major upgrade, such as fitting more hard disks, going from 2 to 4 processors etc., may require the addition of another power module. This should be taken into consideration when consulting your Apricot supplier and ordering the upgrade parts.

There is also an optional Battery Backup Unit (BBU) which must only be installed by a service engineer visit. Consult your Apricot dealer for details.

12 MOTHERBOARD

Motherboard layout

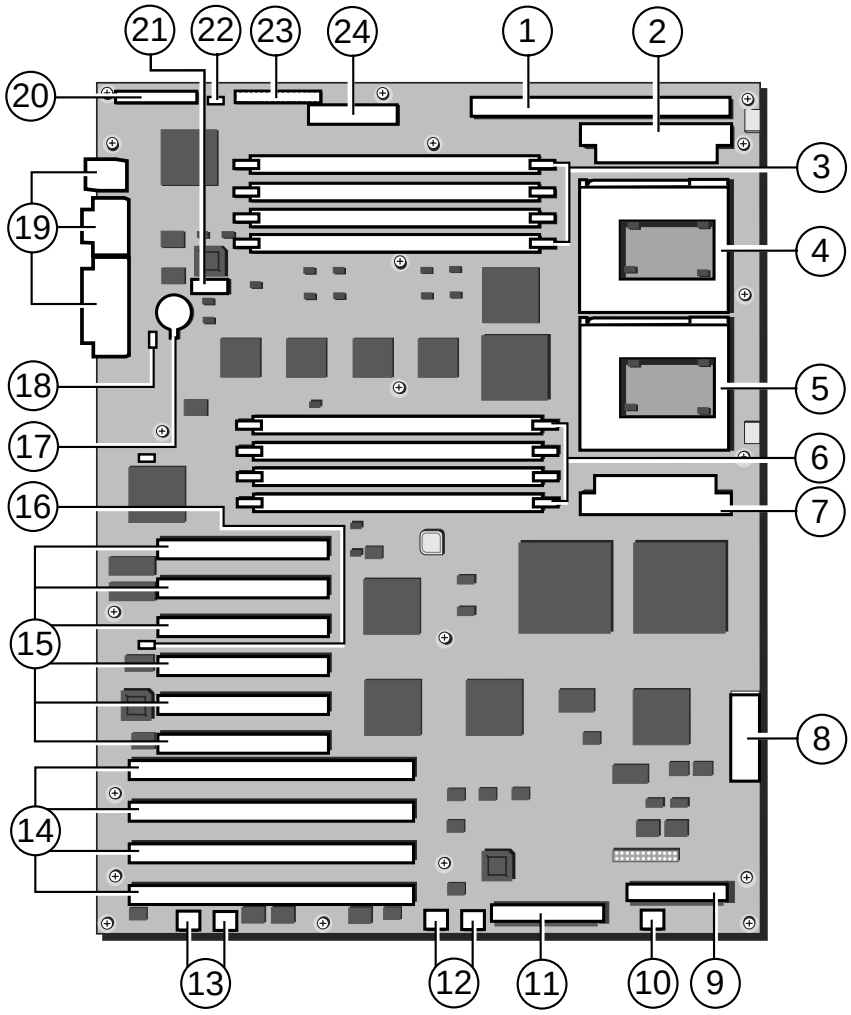


Figure 12-1 Motherboard details

1	Slot for CPU/termination card	13	Busbar connections to PSU
2	VRM8 socket for processor 'B'	14	EISA expansion sockets
3	DIMMs 1 to 4 (top to bottom)	15	PCI expansion sockets
4	ZIF socket for processor 'B'	16	BIOS recovery links
5	ZIF socket for processor 'A'	17	Replaceable CMOS Lithium battery
6	DIMMs 5 to 8 (top to bottom)	18	Clear CMOS links
7	VRM8 socket for processor 'A'	19	System external connections
8	Aux power socket (from PSU)	20	Data connection to power dis. board
9	UltraSCSI (to 1st HDD module)	21	Bus and multiplier switches, SW1-1 to 6
10	Aux. busbar connec. to PSU (not used)	22	FDD mode setting links
11	SCSI connec. for Remov. media drives	23	Floppy disk control connector
12	Busbar connections to PSU	24	Power connections to power dis. board

Expansion Slots

EISA Slots

The four EISA bus slots on the motherboard provide for expansion and performance enhancement. One of these shares a common chassis I/O expansion slot with one of the PCI slots. If you use this for an EISA slot, you cannot use it for PCI.

The EISA bus, an extension of the Industry Standard Architecture (ISA) bus, provides:

- 32-bit memory addressing
- Type A transfers at 5.33 Mbytes per second
- Type B transfers at 8 Mbytes per second
- Burst transfers at 33 Mbytes per second
- 8-, 16-, or 32-bit data transfers
- Automatic translation of bus cycles between EISA and ISA masters
- Interrupt sharing

Note

Since EISA is fully backward compatible with ISA, you can install old or new ISA add-in boards and software in your server.

PCI Slots

The six PCI bus slots on the system board provide for expansion and performance enhancement. There are two on-board PCI controllers.

PCI bus one and two both provide:

- 32- and 64-bit memory addressing
- +5 V signalling environments
- +3 V supply arrangements
- Burst transfers at 133 Mbytes per second
- 8-, 16-, or 32-bit data transfers
- Plug-and-play configuration
- PeerBus to maximise throughput

Note

If plug in SCSI controllers are to be connected, they must be fitted in the lowest PCI slot on the motherboard to avoid boot-up conflicts with the on-board controllers.

Video Controller

The on-board, integrated Cirrus Logic GD54M30 super VGA controller has a direct 32 bit PCI interface. The standard system configuration comes with 1 Mb of video memory.

The SVGA controller supports only analogue monitors (single and multiple frequency, interlaced and non-interlaced) with a maximum vertical retrace interlaced frequency of 87 Hz.

I/O Map (continued overleaf)

I/O Address(es)	*Resource*
0000 – 001F	DMA controller 1
0020 – 0021	Interrupt controller 1
0022 – 0023	EISA bridge configuration space access ports
0024 – 0025	AIP configuration space access ports
0026 – 0027	Configuration Space Access Ports
0040 – 005F	Programmable Timer
0060, 0064	Keyboard Controller
0061	NMI Status & Control Register
0070	NMI Mask (bit 7) & RTC Address (bits 6:0)
0071	Real Time Clock (RTC)
0080 – 008F	DMA Low Page Register
0092	System Control Port A (PC-AT control Port)
00A0 – 00BF	Interrupt Controller 2
00C0 – 00DF	DMA Controller 2
00F0	Clear NPX error
00F8 – 00FF	x87 Numeric Coprocessor
0102	Video Display Controller
0170 – 0177	Secondary Fixed Disk Controller (IDE)
01F0 – 01F7	Primary Fixed Disk Controller (IDE)
0220 – 022F	Serial Port
0238 – 023F	Serial Port
0278 – 027F	Parallel Port 3
02E8 – 02EF	Serial Port 2
02F8 – 02FF	Serial Port 2
0338 – 033F	Serial Port 2
0370 – 0375	Secondary Floppy
0376	Secondary IDE
0377	Secondary IDE/Floppy
0378 – 037F	Parallel Port 2
03B4 – 03BA	Monochrome Display Port
03BC – 03BF	Parallel Port 1 (Primary)
03C0 – 03CF	Enhanced Graphics Adapter
03D4 – 03DA	Colour Graphics Controller
03E8 – 03EF	Serial Port
03F0 – 03F5	Floppy Disk Controller
03F6 – 03F7	Primary IDE - Sec. Floppy
03F8 – 03FF	Serial Port 1 (Primary)
0400 – 043F	DMA Controller 1, Extended Mode Registers.

I/O Address(es)	*Resource*
0461	Extended NMI / Reset Control
0462	Software NMI
0464	Last EISA Bus master granted
0480 – 048F	DMA High Page Register.
04C0 – 04CF	DMA Controller 2, High Base Register.
04D0 – 04D1	Interrupt Controllers 1 and 2 Control Register.
04D4 – 04D7	DMA Controller 2, Extended Mode Register.
04D8 – 04DF	Reserved
04E0 – 04FF	DMA Channel Stop Registers
0678 – 067A	Parallel Port (ECP)
0778 – 077A	Parallel Port (ECP)
07BC – 07BE	Parallel Port (ECP)
0800 – 08FF	NVRAM
0C80 – 0C83	EISA System Identifier Registers
0C84	Board Revision Register
0C85 – 0C86	BIOS Function Control
0CF8	PCICONFIG_ADDRESS Register
0CFC	PCICONFIG_DATA Register
n000 – n0FF	EISA Slot n I/O Space
x100 – x3FF	ISA I/O slot alias address
n400 – n4FF	EISA Slot n I/O Space (n = 1 to 15)
x500 – x7FF	ISA I/O slot alias address
n800 – n8FF	EISA Slot n I/O Space (n = 1 to 15)
x900 – xBFF	ISA I/O slot alias address
nC00 – nCFF	EISA Slot n I/O Space (n = 1 to 15)
xD00 – xFFF	ISA I/O slot alias address
46E8	Video Display Controller

EISA Slot Assignments

EISA Slot (hex)	*Device*
0	System board
1-8	EISA expansion boards
9-A	Embedded SCSI
B	Memory module
C	Memory module (expansion module)
D	Primary PCI segment
E	CPU1 module
F	CPU2 module

Direct Memory Access Channels

Channel	*Device*
0	(add-in board)
1	(add-in board)
2	Diskette drive
3	Reserved
4	Reserved
5	(add-in board)
6	(add-in board)
7	(add-in board)

ISA Interrupts

Device	*Interrupt*
NMI	Parity error
0	Interval timer
1	Keyboard buffer full
2	Reserved, cascade interrupt from slave PIC
3	Onboard serial port B (COM2), if enabled
4	Onboard serial port A (COM1), if enabled
5	(EISA Ethernet when fitted)
6	Onboard diskette (floppy) controller, if enabled
7	Parallel port LPT1, if enabled
8	Real-time clock (RTC)
9	SCSI (e.g. additional 2940 when fitted)
10	(RAID controller cards when fitted)
11	(PCI Ethernet when fitted)
12	Onboard PS/2 mouse port, if enabled
13	Math coprocessor error
14	Reserved for SMIC
15	Reserved for SMIC

Jumper and switch settings

All of the following settings should not normally be changed.

BIOS recovery (Identified at 16 on motherboard diagram)

Pins	*Pins*	*Action*
1-2		Recover
	2-3	Normal

Clear BIOS settings (Identified at 18 on motherboard diagram)

Pins	*Pins*	*Action*
1-2		Normal
	3-4	> 1 sec. discharge

Floppy drive mode (Identified at 22 on motherboard diagram)

Pins	*Pins*	*Pins*	
1-3	2-4		3-mode operation (Japan only)
		3-4	Normal 2-mode operation

SW1 - Bus and clock multiplier settings

External bus clock		
Frequency	SW1-5	SW1-6
66Mhz	off	on
60Mhz	on	off
50Mhz	on	on

Processor bus multiplier				
SW1-1	SW1-2	SW1-3	SW1-4	Factor
on	on	on	on	x2
on	off	on	on	x2.5
on	on	off	on	x3
on	off	off	on	x3.5
on	on	on	off	x4

All other switch combinations are reserved.

Warning

Do not alter the processor or clock settings under normal operation unless upgrading all the fitted processors. It could result in permanent damage to either the motherboard or the processors.

Bus connections and ports

On-Board SCSI Controllers

The system board includes two Adaptec controller chips, channels A and B, interfacing directly to the second PCI bus.

SCSI bus A

Controlled by an on-board Adaptec AIC7850 having integrated single ended SCSI drivers for direct connection to an 8 bit fast (10Mhz) bus. Bus connection is via a 50 pin header. This is a provision for direct control of devices such as SCSI CD-ROM or Tape drives fitted in the front, removable media, drive bay.

SCSI bus B

Controlled by an on-board Adaptec AIC7880 similar to the above, but for connection to either fast (10Mhz) or ultrafast (20Mhz) bus. Bus connection is via a 68 pin 'P' type connector. This is a very high specification device aimed at UltraSCSI hard drives.

In both cases the Adaptec SCSI bus is incorporated into the motherboard BIOS. Both bus systems have active termination, the power supply for which is protected by a 1A resettable fuse. This in turn is monitored by the system management cards.

Active negation outputs reduce the chance of data errors by actively driving both polarities of the SCSI bus and avoiding indeterminate voltage levels and common-mode noise on long cable runs. The SCSI output drivers can directly drive a 48 mA, single-ended SCSI bus.

Power Connections

The main power input to the motherboard is via two sets of 5V connections at the bottom of the board. These are designed to be fitted with supply busbars direct to the Power Supply Unit (PSU) located in the bottom of the server. The PSU can function as an Uninteruptable Power Supply (UPS), when the optional Battery Backup unit (BBU) is fitted. In the case of mains interruptions or failure, it allows the system to be shut down in a prescribed and orderly manner.

All the other required voltages for add-in EISA/ISA boards, PCI boards, and the system board are supplied through the auxiliary connector on the lower right side of the motherboard. All power connector pins are rated at 5 amperes. In addition there are connections at the top of the motherboard for the supply to the Power Distribution board, which in turn, returns a 3.3 v. supply required by system logic.

Floppy disk

There is a standard floppy disk interface provided at the top of the motherboard. This will normal be ribbon cabled to the removable media drive bay and the floppy drive. The system can boot from this drive providing permission has been assigned in the BIOS setup.

Parallel Port

The parallel and video connectors share a common housing. When viewed on the rear panel, the parallel port is on the right.

Pin	Signal	Pin	Signal
1	Strobe	10	ACK (acknowledge)
2	Data bit 0	11	Busy
3	Data bit 1	12	PE (paper end)
4	Data bit 2	13	SLCT (select)
5	Data bit 3	14	AUFDXT (auto feed)
6	Data bit 4	15	Error
7	Data bit 5	16	INIT (initialise printer)
8	Data bit 6	17	SLCTIN (select input)
9	Data bit 7	18-25	GND (ground)

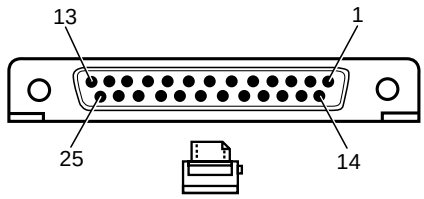


Figure 12-2 Parallel Connector

Serial Ports

These identical PS/2 compatible connectors share a common housing. When viewed on the rear panel, COM2 is on the left and COM1 is on the right.

Pin	Signal	Pin	Signal
1	DCD (data carrier detect)	6	DSR (data set ready)
2	RXD (receive data)	7	RTS (request to send)
3	TXD (transmit data)	8	CTS (clear to send)
4	DTR (data terminal ready)	9	RIA (ring indicator)
5	GND (ground)		

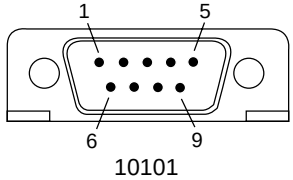


Figure 12-3 Serial Port

VGA Video Port

When viewed on the rear panel, the video port is on the left.

Pin	Signal	Pin	Signal
1	Red	10	GND (ground)
2	Green	11-12	NC (not connected)
3	Blue	13	HSYNC (horizontal sync)
4	NC (not connected)	14	VSYNC (vertical sync)
5-8	GND (ground)	15	NC (not connected)
9	NC (not connected)		

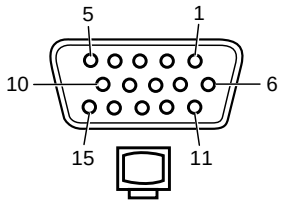


Figure 12-4 VGA Video Connector

Keyboard and Mouse Connectors

These identical PS/2 compatible connectors share a common housing. When viewed on the rear panel, the keyboard connector is on the left and the mouse connector is on the right.

Keyboard		Mouse	
Pin	Signal	Pin	Signal
1	KEYDAT (keyboard data)	1	MSEDAT (mouse data)
2	NC (not connected)	2	NC (not connected)
3	GND (ground)	3	GND (ground)
4	FUSED_VCC (+5 V)	4	FUSED_VCC (+5 V)
5	KEYCLK (keyboard clock)	5	MSECLK (mouse clock)
6	NC (not connected)	6	NC (not connected)

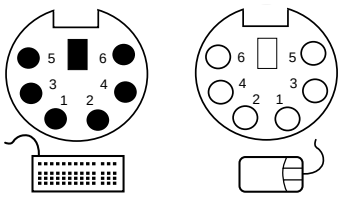


Figure 12-5 PS/2-Compatible Keyboard and Mouse Connectors

13 SYSTEM MANAGEMENT CARDS

This section first details the **System Management Interface Card** (SMIC) and then the **System Management Controller** (SMC) with its associated daughterboard (SMI2C).

The SMIC card **must always** be fitted to the very lowest EISA slot. Using any other slot may cause the System Management Application software to report incorrect motherboard configuration.

System Management Interface card (SMIC)

Specification

The following list describes the general characteristics of the SMIC:

- ISA plug-in card
- Extended BIOS - 128 Kbytes with 32-Kbyte and 16-Kbyte pages
- 32 Kbytes SRAM with 8-Kbyte pages
- Flash disk - 2 Mbytes with 8-Kbyte pages; 12V programming voltage generator
- Diagnostic Processor (DiagP) - 87C51; drives RESET#/NMI# /IOCHCK#; serial link to SMC; port 80 monitor port, CTRL-ALT-DEL reset detection
- Management serial link (COMx)
- Diagnostic serial link
- Port 80 monitor - Catches port 80 accesses; DiagP reads out values and sends them to SMC
- Connectors - Power distribution interface: 34-way IDC

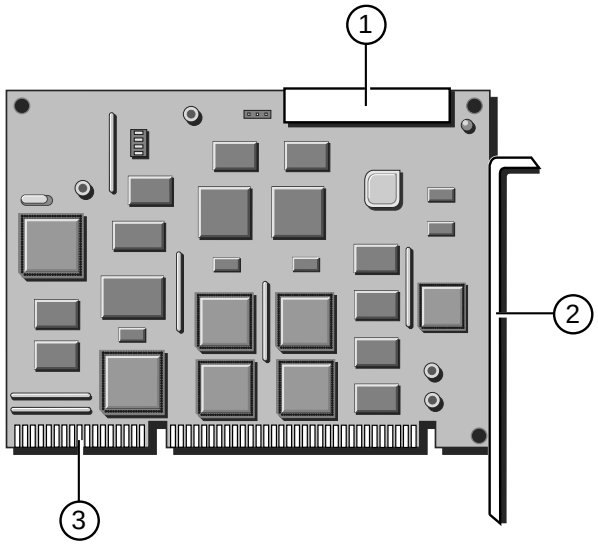


Figure 13-1 System management interface card (SMIC)

1	Interface ribbon connector	3	Standard ISA plug-in connection
2	Standard fixing plate		

Descriptions

Memory

The on-board memory occupies a contiguous 32-Kbyte address space, the base being at C8000h or D0000h (jumper selectable). All memory is 8-bit only. The following table shows the memory map:

Offset	Device	Page Size	Total Size
0000	BIOS page, SRAM and DOS FLASH disabled BIOS page, SRAM and DOS FLASH enabled	32 Kbytes 16 Kbytes	128 Kbytes
4000	DOS Flash page	8 Kbytes	2 Mbytes
6000	SRAM	8 KBytes	8 KBytes

The BIOS is a 12V non-sectored Flash device. Since it is not critical to the system boot process, no jumper mechanism is present to enable an alternative 'boot' block.

The Flash disk is a 2-Mbyte 12V part. Since the part requires a tight-tolerance 12V rail, a DC/DC converter generates the programming voltage. The part is protected from programming via an Apricot port.

The 32-Kbyte SRAM is for use by the BIOS as a stack or for other storage purposes.

On card reset, the SRAM and DOS Flash are disabled, being enabled by the BIOS through the Apricot Control Register.

I/O Map

I/O Address	Port
0800h : write	Port 80 Diagnostic Port
0120h : write	BIOS page register
0120h : read	Status register
0121h : write	DOS Flash page register
0122h : r/w	Control register
0123h - 0127h	Reserved for expansion
0128h - 012Fh	Diagnostic UART
03E8h - 03EFh	COM3
02E8h - 02EFh	COM4

= Unused portion of memory

Port 80 Monitor : 0080h : write

This 8-bit port captures all diagnostic codes written by the motherboard BIOS. The port is readable by DiagP, which can then communicate the codes to the SMC. If the port contents are lost due to overrun by the motherboard, there is no problem; the aim is merely to keep track of the last value in the event that the system hangs.

When the port is written, the DiagP must be informed through an interrupt line (PORT80_IRQ).

When the DiagP reads the port, the interrupt line must be automatically reset.

BIOS Page Register 120h (write only)

This controls the BIOS and SRAM paging. All bits are cleared on reset. When the Flash disk/SRAM decoding is disabled, the BIOS has a page size of 32 Kbytes. Bit 4 of the Control Register = 0.

Bits	*Function*
7:3	n/a
2:1	BIOS page (0 - 3)
0	n/a

When Flash disk/SRAM decoding is enabled, the BIOS has a page size of 16 Kbytes. Bit 4 of the Control Register = 1

Bits	*Function*
7:3	n/a
2:0	BIOS page (0 - 7)

DOS Flash Page Register 121h (write only)

This controls the Flash disk paging. All bits are cleared on reset.

Bits	*Function*
7:0	Flash disk page (0 - 255)

SRAM Page Register 123h (write only)

This controls the SRAM paging. All bits are cleared on reset.

Bits	*Function*
7:2	n/a
1:0	SRAM page (0 ® 3)

Control Register 122h (R/W)

This contains miscellaneous control bits. All bits are cleared on reset.

Bits	Function
7:6	IRQ select for COM port: 00 = No IRQ selected 01 = IRQ10 10 = IRQ14 11 = IRQ15
5	Management UART address: 0=COM3: 1=COM4
4	Enable DOS Flash/SRAM decode: 1=enable
3	Enable DOS Flash write: 1=enable
2	Enable BIOS Flash write: 1=enable
1:0	IRQ select for Diagnostic UART: 00 = No IRQ selected 01 = IRQ10 10 = IRQ14 11 = IRQ15

Status Register

This register contains miscellaneous control bits. All bits are cleared on reset.

Bits	Function
7:4	4-way switch pack : read only, 0 = on
3	Flash RDY line : read only, 1 = ready
2	n/a
	DiagP, IOCHCK# line : read only
	DiagP NMI# line : read only

Management UART (COM3 or COM4)

This is a standard 16550-compatible serial port, occupying 8 contiguous bytes. The Management UART interrupt is software selectable (Apricot Control Register) to be IRQ10, IRQ14 or IRQ15. The serial interface uses TTL levels.

Diagnostic UART

This is a standard 16550 compatible serial port, occupying 8 contiguous bytes. The UART interrupt is software selectable (Apricot Control Register) to be IRQ10, IRQ14 or IRQ15. The serial interface uses TTL levels.

Diagnostic Processor

The Diagnostic Processor has its own power-on reset, as it holds the entire motherboard in reset while its firmware initialises.

Port 0 : Input data port

The data source is selected via port 2.

Bits	Function
7:0	Port 80 diagnostic code (Port 0 : Input Port)
3	Ambient Temperature: 1 = over temperature (System Status Monitor)
2:0	Fan fail; 1=fail (System Status Monitor)

Port 1

Bits	Function
4	Motherboard reset - active high

Port 2

Bits	Function	Dir
4	Port 80 port read : active low	o/p
1	System status port read: active low	o/p

Port 3

Bits	Function	Dir
7	Motherboard NMI# - active low	o/p
6	ISA IOCHCK# - active low	o/p
5	Clear warm reset interrupt - active low	o/p
4	Diagnostic mode select - active low	i/p
3	Interrupt : warm reset	i/p
2	Interrupt : port 80 monitor	i/p
1	Serial port Tx	o/p
0	Serial port Rx	i/p

System Management Controller (SMC) and its Daughterboard (SMI2C)

The purpose of the System Management Controller (SMC) is to monitor and report the status of your system in terms of its integrity. It functions as the interface between the following:

- Power Supply modules
- Battery back up unit (optional)
- Motherboard via the System Management Interface Card (SMIC)
- Front Panel
- Fans

Whenever the server develops a problem, perhaps a faulty disk drive or too high a temperature within the server, the SMC reports it to the System Management Application, which is a Windows program that interprets the reports that the SMC sends.

In addition there is a modem port which appears on the back panel of the server. This is a standard serial interface which enables monitoring of the system from a remote computer.

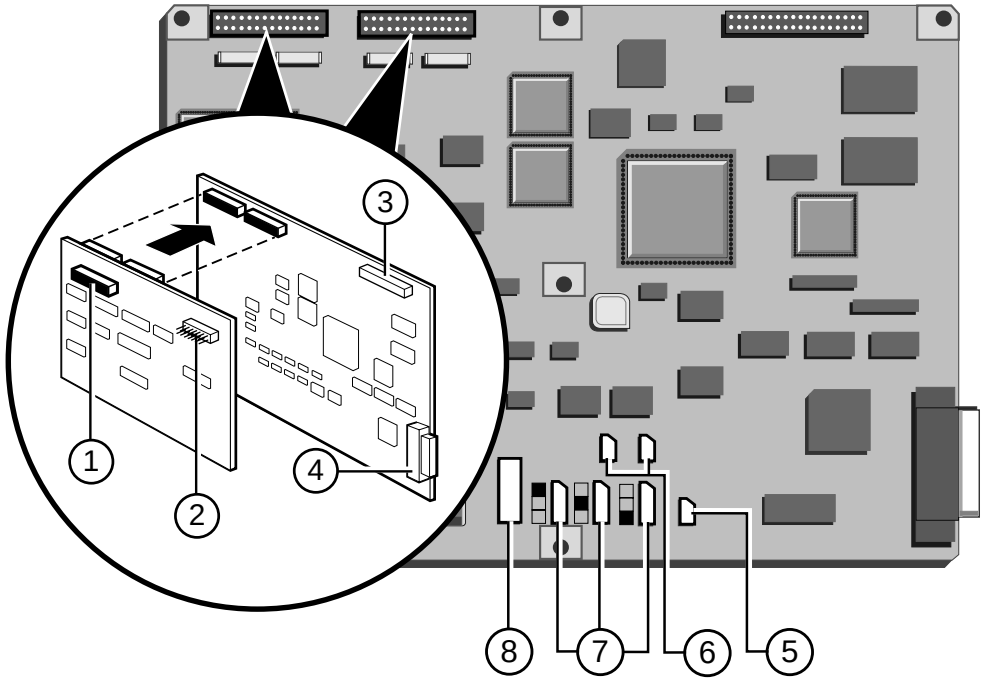


Figure 13-2 SMC and SMI2C assembly

1	Front panel interface (on SMI2C)	5	Panel lock sensor switch input
2	PSU interface (on SMI2C)	6	Thermistor connections
3	Power distribution board interface	7	Fan connections
4	Modem/serial port	8	Power connector

The SMC has the following attributes:

- Validates the infrared data stream from the Front Panel.
- Sends data to Front Panel
- Communicates via a dedicated serial interface to the motherboard, by means of the SMIC
- Provides power to the fans in the disk chamber
- Monitors the state of the power supply modules and (if fitted) the battery back up unit.
- Contains a Real-Time Clock (RTC) which maintains the date and time
- Contains an 80186 processor chip which functions as an embedded controller rather than a microprocessor
- Equipped with 256K Kbytes of SRAM, which shadows the EPROM or the Flash device to enhance the speed of the system
- Contains Flash ROM in order to provide the firmware for the functions of the Front Panel.

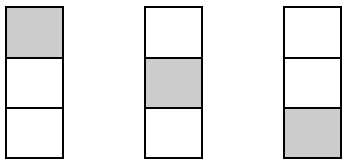


Figure 13-3 The fan connections

14 POWER SYSTEM

Power Distribution boards

There are various power distribution boards in your server (see the service section for their removal instructions.) They are associated with the following components:

- Motherboard
- Removable media drive bays
- Hard disk drives
- Electronics chamber cooling fans

The main purpose of these boards is to distribute power from a single source to several different components. However, the motherboard power distribution and the cooling fan board have additional functions. The following paragraphs explain the additional functions that apply to each board.

Motherboard Power Distribution Board

There are several additional functions for this board, but the main ones are:

- The audio signals from the motherboard and the system controller are mixed and amplified and sent to the loudspeaker.
- The board is also a collection point for signals to and from the various System Management and controller cards.
- The board contains a 5 to 3.3 Volt DC-DC converter.
- The board also contains an internal temperature sensor.

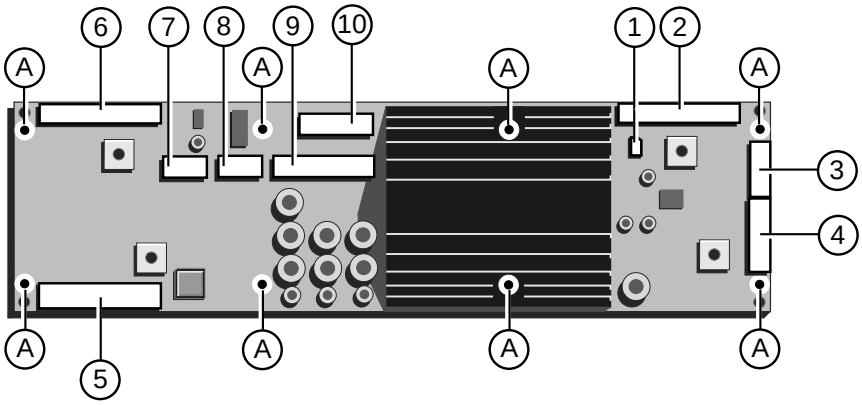


Figure 14-1 Motherboard Power Distribution Board

A	Mounting screw holes (x8)		
1	Loudspeaker connection	6	SMIC ribbon connector
2	Data from motherboard	7	Power to/from motherboard
3	Cooling fan connector	8	Power to/from motherboard
4	Aux. power connector	9	Power to/from motherboard
5	SMC ribbon connector	10	3.3 v supply to motherboard

Cooling Fan Board (motherboard fans)

This small board has the following important functions:

- One power/signal ribbon cable socket for the cable from the motherboard power distribution board, (1).
- An input from the sensor switch of the side panel lock, (2).
- Three power connectors for the fans, (3, 4, and 5). A small printed graphic on the board indicates which fan connects to which socket.
- One thermistor mounted on the board which serves as an ambient temperature sensor, (6).

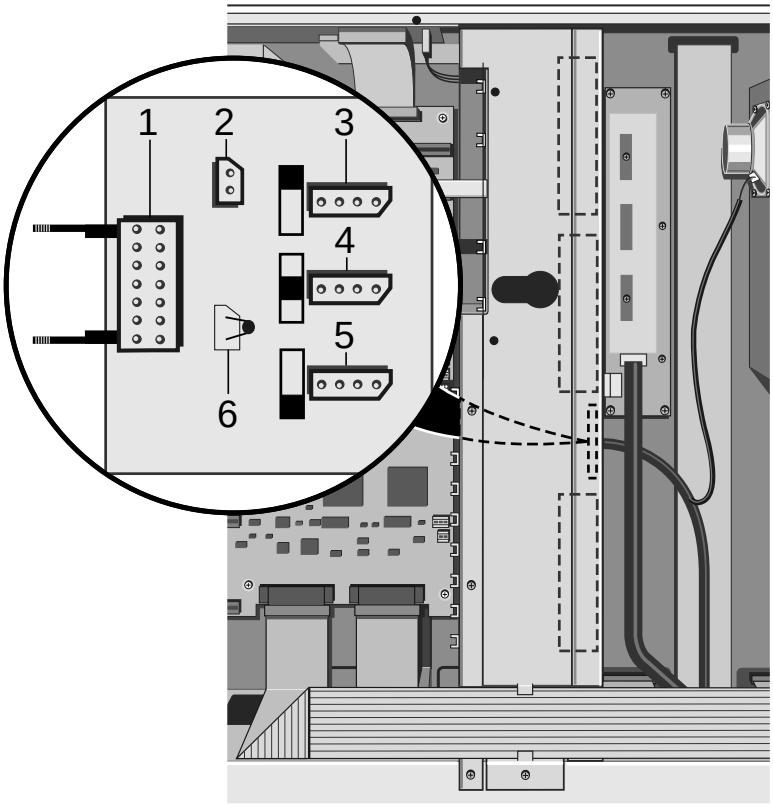


Figure 14-2 Cooling fan board

Supply

The power supply voltage selection is auto-ranging. This means that there is no selector switch on the unit. It will detect the supply voltage and function normally with no effort on your part. The voltage range for the power supply unit is from 85 to 253 volts, at a frequency of 47 to 63 Hz.
It is recommended to avoid subjecting the PSU to voltages outside this range.

Power Supply Components

Information about Power Supply Modules is given in chapter 10 along with removal and fitting instructions. There is also detail about the optional Battery backup Unit (BBU), both removal and refitting.

Each module is rated at a total output power of 267W and there can be up to 4 modules.

Power

The following power rails are available within the system:

Control	Voltage and current
DC0-2	+5V rail at 81A
DC3, DC4	+12V rail at 33A
DC5	-5V rail at 500mA
DC6	-12V rail at 500mA
DC7	5V standby rail at 800mA

The above ratings are for three power modules, the fourth being a 'redundant' module.

Control Interface (includes serial I²C bus)

The PSU is controlled by an external module through its control interface. The PSU provides the control interface signals on a flying ribbon cable terminated by a flush mounted IDC connector.

The control interface signals are:

Signal	Function
Power Up:	Turns on DC0-6 outputs.
Shutdown:	Turns off DC0-6 outputs.
DC good:	Digital output indicates that the DC0-4 output rails are within spec.
AC good	Digital output indicates when true that the AC input voltage is suitable and that the PSU is currently powered by the AC input only.
0V	Reference for the control interface.
SDA	I²C bus data input / output
SCL	I²C bus clock input / output

Power Up input

In Standby (with AC input present), connecting this input to 0V until the PSU asserts DC Good will power up the PSU. The input will be held for a maximum of 1 second, if DC Good fails to become asserted, then the outputs DC0-6 and considered to have failed

The open circuit voltage on the Power Up input does not exceed 30V, and the current flowing in or out of the input is below 16mA. The maximum logic 0 input voltage is 0.5V. The input will not respond when less than 20uA is drawn from it. The System Management Unit drives this input with an open collector NPN transistor circuit.

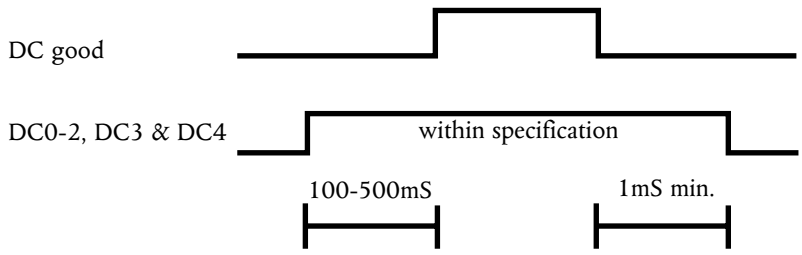
Shutdown input

Driving this input to logic 0 when the DC0-6 outputs are on will return it to Standby or Power Off mode. Shutdown has no effect when the PSU is in Standby mode or when the Power Up input is active. The PSU should acknowledge recognition of Shutdown active by negating DC good. This should take no longer to signal than 1 second. The System Management Unit may then immediately release Shutdown.

DC good output

The active high DC good output is be driven high between 100mS and 500mS after the DC rails are stabilised within specification after power up. Note that the DC5 and DC6 outputs (-5V and -12V) are not monitored by this function, however they are directly sensed by the System Management Unit.

When the PSU powers down (except in fault conditions) the DC good signal should be driven low at least 1mS before the DC outputs deviate from their specified ranges. This output must be valid at all times as it is critical to the operation of the computer system. It does not glitch during AC disturbances or when the PSU is changing between operating modes. If any DC0-2, DC3 or DC4 output module fails DC good will go low immediately.



Output drive (logic high):	2mA at 3.1V min. Max. open-circuit voltage 5.5V.
Output drive (logic low):	8mA at 0.5V max.

AC Good

This output indicates that the AC supply is within specification. The System Management Unit uses this output to recognise whether the DC output modules are powered by AC input or by the battery. This output is activated (logic high) in the Standby and Power On modes. It is negated (logic low) in the Backup and Power Off modes.

Output drive (logic high):	2mA at 3.1V min.
Output drive (logic low):	8mA at 0.5V max.

Digital Control Interface Summary

Signal	*PSU I/O*	*True*		*False*	
		Level	*Meaning*	*Level*	*Meaning*
Power Up	Input	0	Standby: go to Power On (acknowledge: DC Good=true)	1	No action
Shutdown	Input	0	Power On: go to Standby (acknowledge: DC Good=false)	1	No action
AC Good	Output	1	AC input is suitable and the PSU is powered entirely by AC	0	AC input out of spec. PSU may draw battery current
DC Good	Output	1	DC outputs 0-2, 3 and 4 are within spec.	0	One or more are not within spec

PSU state diagram

The "Deep discharge" transition on the state diagram, shown below, occurs when the PSU detects a very low battery voltage while it is providing a Standby 5V supply in Power Off mode. This can occur due to excessive battery drain or the batteries being disconnected by the removal of the BBU link. In the case of battery exhaustion in Backup mode, the PSU will remain in the Power Off state for at least 0.5 seconds before entering the Dead state. If the BBU link is used to disconnect the batteries, the transition from Backup to Dead may be instantaneous. If no BBU is present this transition may be instantaneous.

DC 7 is provided by an independent supply path. DC 7 maintains it output for longer than the DC Good requirement.

The "Fault" entries in the table below correspond to the equivalent transitions on the state diagram. Other PSU failures may also cause the "Fault" transition.

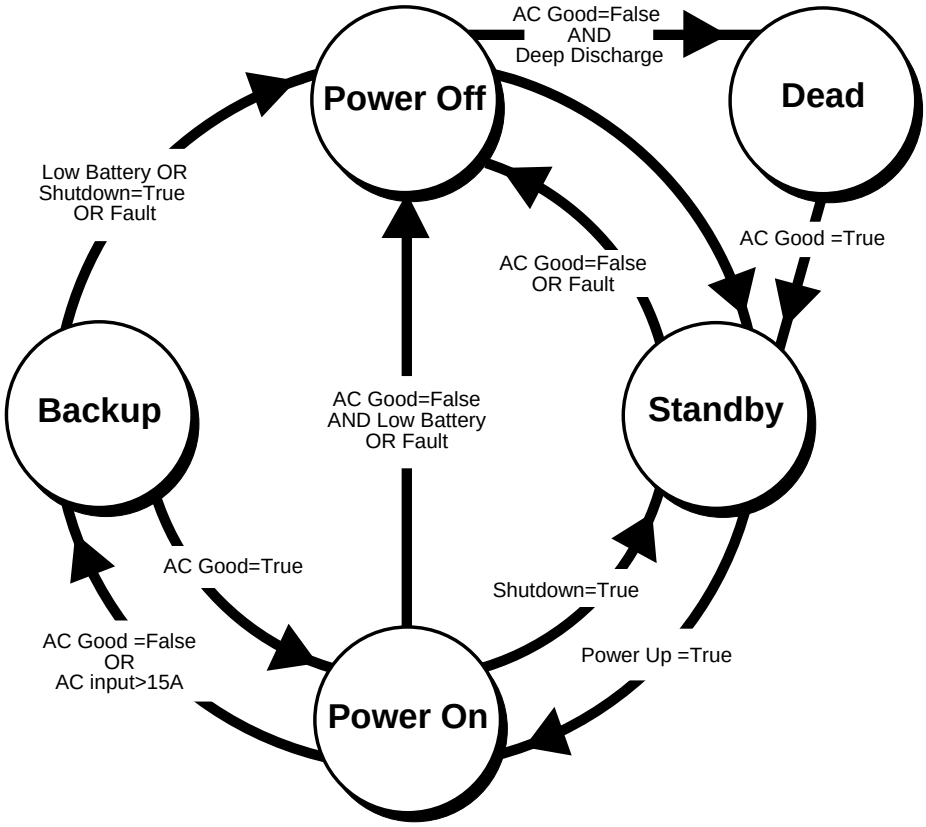


Figure 14-3 PSU State Diagram

Condition	DC0-2, DC3, DC4	DC5	DC6	DC7
Overcurrent	Fault	Limit	Limit	Limit
Undervoltage	Fault	N/A	N/A	N/A
Overvoltage	Fault	N/A	N/A	N/A

PSU mode truth table

State	AC Good	DC Good	DC7
Dead	Don't care	Don't care	Off
Power Off	False	False	On
Standby	True	False	On*
Power On	True	True	On*
Backup	False	True	On*

On*, Output is on in all except current limiting conditions on this output.

Serial Communication Protocol

There is a single I^2C control serial control bus in the PSU.

The following I^2C slave addressed devices exist within the product. The slaves should be addressable in all states except dead.

Address	Channel	Function	Meaning
0x48	0	AC Voltage	Current AC voltage
0x48	1	AC Current	Current AC current
0x48	2	Feedback	¼ of output of Aout signal
0x49	0	DC Volts +ve	Current DC voltage of BBU
0x49	1	DC Current	Current DC Current level
0x49	2	DC Charge Current	DC Charge current
0x49	3	DC Volts -ve	Bias to 80V
0x22	0	Configuration	Details of items present in PSU
0x23	0	Situation OK	Current health of PSU units
0x4C	0	Output current DC0-3	Current level in DC 0-3
0x4C	1	Output Current DC4	Current level in DC 4
0x4C	2	PSU temperature	digital representation of current PSU temperature
0X4C	3	Shared 5V	bus voltage

Returned Values

To each of the above functions are returned data to the following format:

AC Voltage

AC Voltage is an RMS representation of the current AC voltage measured at the AC input of the PSU. The representation of the voltage is a byte value that is read through the I^2C bus at the address indicated in the above table. The returned value is linear to the input voltage and conforms to the range 00=0V and FF=270V. The accuracy of the output is approximately 2.5%.

AC Current

AC Current is an RMS representation of the current AC Current measured at the AC input of the PSU. The representation of the current is a byte value that is read through the I^2C bus at the address indicated in the above table. The returned value is linear to the input voltage and conforms to the range 00=0A and FF=20A. The accuracy of the output is approximately 5.0%.

Feedback

A analogue feedback of ¼ of the current analogue output setting.

DC Volts

DC Volts is an RMS representation of the current DC voltage measured at the terminals of the batteries in the PSU. The representation of the voltage is a byte value that is read through the I^2C bus at the address indicated in the above table. The returned value is linear to the input voltage and conforms to the range 00=80V and FF=120V. The accuracy of the output is approximately 2.5%. The measurement is made in a differential mode between pin 1 and 4 of the device.

If the BBU is not present , the I^2C slave conversion device is not present.

DC Current

DC Current is an RMS representation of the current DC current measured within the batteries in the PSU. The representation of the current is a byte value that is read through the I^2C bus at the address indicated in the above table. The returned value is linear to the input voltage and conforms to the range 00=0A and FF=15A. The accuracy of the output is approximately 2.5%.

If the BBU is not present , the I^2C slave conversion device is not present.

DC Charge Current

DC Charge Current is an RMS representation of the current DC charge current measured within the batteries in the PSU. The representation of the current is a byte value that is read through the I^2C bus at the address indicated in the above table. The returned value is linear to the input voltage and conforms to the range 00=0A and FF=0.5A. The accuracy of the output is approximately 2.5%.

If the BBU is not present , the I^2C slave conversion device is not present.

Configuration

An 8 bit indication of the current configuration of the PSU..

1 indicates presence and 0 indicates not present.

Bit	*Object*
0	PSU 0 inserted
1	PSU 1 inserted
2	PSU 2 inserted
3	PSU 3 inserted
4	BBU inserted
5	RESERVED
6	REVISION BIT 1 (Set to 1)
7	REVISION BIT 0 (set to 0)

Situation OK

The following table shows an 8 bit representation of the functioning of the units within the PSU.

A bit value of 1 indicates functioning correctly and 0 indicates failure.

Bit	Object
0	PSU 0 OK
1	PSU 1 OK
2	PSU 2 OK
3	PSU 3 OK
4	Charger BBU OK and in circuit
5	DC Output Fan 1 Status
6	DC Output Fan 2 Status
7	BBU test Mode

PSU (x) OK

1 indicates that the PSU in question is functioning correctly.

0 indicates failure of the unit.

Charger BBU OK and in circuit

1 indicates that the batteries are in circuit and being float charged correctly by the PSU.

0 indicates batteries are out of circuit or charger failure.

DC Fan Status

1 indicates fan functioning correctly.

0 indicates fan failure.

BBU test mode

This will start the BBU running forcing the PSU to load share between the AC and DC stages. This will confirm that the PSU's Battery stage functions correctly. Writing a 1 will select this mode and writing a 0 will cancel this mode.

DC Current DC0-3

DC Current DC0-3 is an RMS representation of the current DC current measured within the DC0-3 output of the PSU. The representation of the current is a byte value that is read through the I^2C bus at the address indicated in the above table. The returned value is linear to the input voltage and conforms to the range 00=0A and FF=100A. The accuracy of the output is approximately 2.5%.

DC Current DC4

DC Current DC4 is an RMS representation of the current DC current measured within the DC4 output of the PSU. The representation of the current is a byte value that is read through the I^2C bus at the address indicated in the above table. The returned value is linear to the input voltage and conforms to the range 00=0A and FF=40A. The accuracy of the output is approximately 2.5%.

PSU Temperature

A representation of the current PSU temperature.

15 DIAGNOSTIC CODES REFERENCE

This lists the diagnostic codes that your server can produce. Some of these codes indicate errors or malfunctions; others are simply way-markers that indicate normal progress. The codes can appear in the server's front panel LCD display or on the screen in the System Management Application (SMA) software.

Note

Some codes described in this guide will seem obscure to less experienced users, particularly those codes which appear on the Front Panel LCD. If you cannot understand the meaning of a code, ask an authorised engineer for help.

Codes that appear on the Front Panel LCD

When you press the POWER ON button from Standby mode, the server initiates several phases in the boot process. During these phases the system performs the following operations:

- Checks the Diagnostic Processor.
- Checks the System Management Controller (SMC).
- Checks the BIOS, which executes the Power On Self Test (POST).
- Loads the Operating System.
- Attaches the Device Driver and associated clients.

There is a set of diagnostic codes, expressed as hexadecimal numbers, associated with each phase. If your server fails to complete any of these phases, the system will halt and one of the codes will flash on and off on the front panel LCD display. The code represents the point at which the power-on sequence came to a stop and may indicate what element of the system could be at fault.

The appearance of some codes may require an engineer to deal with the problem. In this case, be sure to do the following:

1. Note down the code to help the engineer diagnose the fault.
2. Clear the LCD (and silence the alarm if it is sounding) by using the key to turn the front drive bay door lock to the Unlock position (door closed). If it is already in the Unlock position, turn it to Lock and then to Unlock again.

Normal display

If all steps proceed normally, when the system is up and running and the last client is correctly logged, the front panel LCD will be displaying **0000**.

Power Failure Codes

The LCD will display these codes if the AC power supply fails, assuming a Battery Backup Unit (BBU) is fitted. These codes, shown in brackets below, represent three power failure modes. In each mode, the BBU powers the system.

Each code uses a countdown timer, indicated by *nnn*, to indicate the number of seconds before its mode expires and the next mode begins. If the countdown begins at 1000 or greater, the LCD will display 999 and hold until the countdown actually reaches 999. The LCD will display the progress of the countdown from then on.

- **Brownout mode** (**A.*nnn***) This mode indicates a temporary reduction or even absence of the AC electric power. If full power is not restored after approximately five seconds, Brownout mode will change to Battery mode. If the battery charge is already low and power consumption is high, the system may skip Battery mode altogether and jump to Power Fail mode. But, if power is fully restored before the countdown reaches zero, system functions will return to normal and the batteries will start to recharge.
- **Battery mode** (**b.*nnn***) This mode starts if power has not been restored in Brownout mode. The system warns users to save their work, terminate their applications and log off the network. System shutdown is initiated in this mode. If power is fully restored before the countdown reaches zero, the system will return to normal function and recharge the batteries, otherwise Power Fail mode begins.
- **Power Fail mode** (**F.*nnn***) In this mode, power has not yet been restored; system shutdown should be in progress to prevent deep battery discharge. Shutdown continues even if power should be restored at this late stage.

Under normal conditions, the server deals with the power failure itself by means of the Event Manager and, when necessary, initiates system shutdown.

However, if an AC power outage occurs and persists when the Event Manager is **not** loaded, then the server is not able to initiate system shutdown. You, or some other person who is local to the server, will need to do it yourself while the system is in Battery mode. The precise steps you need to take to shut down the system, after instructing network users to close their applications and log off, will depend on the operating system you are using. When the operating system is at the point where it is safe to switch the machine to Standby, press and hold the STANDBY button on the front panel until the system switches off.

System Management Controller (SMC) Error Codes

This section contains SMC error codes. These codes fall into two groups, the range 0F01-0F0F and the range 0F10-0F4F.

0F01-0F0F

These are initialisation codes for the SMC which will only appear immediately after power-up. If the system stops and the LCD flashes one of these codes, it means that there is a serious hardware problem with the SMC board and it probably needs replacing. The following table defines these codes:

Error Code	*Error Factor*
0F01	80C186EB internal H/W (general purpose register) error
0F02	80C186EB internal H/W (flag register) error
0F03	80C186EB internal H/W (timer) error
0F04	SC's SRAM write/read test error
0F05	SC's EPROM checksum error
0F06	SC's FLASH checksum error
0F07	Copy from FLASH to SRAM failed
0F08	Copy from EPROM to SRAM failed
0F09	RTC's RAM write/read test error
0F0A	A/D converter's busy bit error
0F0B	SC's FLASH is not programmed
0F0D	UART1 internal loop test failed
0F0E	UART2 internal loop test failed

Error Code	*Error Factor*
0F0F	UART1 and UART 2 internal loop test both failed

0F10-0F4F

These codes indicate various other errors and could appear on the LCD at any point. The following list defines the codes and indicates what action you should take if these errors occur. If an error persists and efforts to solve the problem prove ineffective, you should contact a service engineer.

0F10 Power On Error - This code appears when the firmware does not detect a power-on signal from the POWER button within one second. Possible faulty items are the motherboard, the SMC board, the SMIC or the cabling between them. Try pressing the POWER button again.

0F11 Power Off Error - Appears when the system will not shut down after pressing the STANDBY button on the front panel. Possible faulty items are the main circuit board, the SMC board or the cable between them. If it is absolutely necessary to shut down the server, you can disconnect the BBU link on the rear panel and unplug the mains lead. Only do this, however, as an absolute last resort.

0F12 SMC Watchdog Timer over-flow error - Indicates a faulty SMC board or the SMC firmware. If this code appears, first try resetting the SMC by doing the following:

1. Unlock the removable drive bay door to deactivate the security alarm (see chapter 2.)
2. Press the CONTROL, STANDBY and RESET buttons simultaneously. This action displays “8888” on the LCD.
3. Press STANDBY and RESET simultaneously. This clears the LCD and resets the SMC.

If the error code persists, contact a service engineer.

0F13 Too many time-out errors - Indicates faulty SMC board. Try resetting the SMC using the same procedure as for 0F12.

0F15 Invalid interrupt - Indicates a fault in either the SMC board or firmware.

0F20 Diagnostic Processor communication error - Indicates an error in the diagnostic processor on the System Management Interface Card (SMIC), the power distribution board or the cable between them.

0F30 SMC port retry-error occurred - Indicates an error in the SMC board, the SMIC board, the motherboard power distribution board, the cable between them, firmware, or the setting of the SMC (or FPSC) variables. First check the settings of the FPSCResponseTimeOut and FPSCReceiptTimeOut variables in the System Management Application (SMA).

0F31 SMC port Response time-out occurred - Same as for 0F30.

0F32 SMC port Transmit time-out occurred - Indicates faulty SMC board or firmware.

0F40 Modem port retry-over occurred - Indicates a faulty modem, modem cable, telephone line, SMC board, settings of SMC (or FPSC) variables in the SMA. You should check the following items first:

1. The modem is connected correctly.
2. The modem is switched on.
3. The modem is connected to the telephone line correctly.
4. The modem works correctly. To double-check this, connect a different modem that you know is in working order.

5. The serial port settings for the modem (e.g. baud rate) are correct.
6. Settings of the MODEMResponseTimeOut and MODEMReceiptTimeOut variables, in the SMA, are correct.

0F41 MODEM port Response time-out - Same as 0F40.

0F42 MODEM port Transmit time-out - Same as 0F40.

0F4D MODEM AT command result code time-out occurred - Indicates faulty modem, modem cable, SMC board or SMC (FPSC) variable settings. You should check the following items first:

1. The modem is connected correctly.
2. The modem is switched on.
3. The modem connection to the telephone is in order.
4. The modem functions properly. To double-check this, connect a different modem that you know is in working order.
5. The serial port settings for the modem (e.g. baud rate) are correct.
6. The settings of the MODEMATOriginal, MODEMATCommands and MODEMPortBaudRate variables, in the SMA, are correct.

0F4E MODEM AT command failed - Same as 0F4D.

0F4F MODEM AT command unexpected result code is received - Same as 0F4D.

Progress Control (NextBootStage) Codes

A single SMC (FPSC) variable, NextBootStage, records the progress of all phases of the boot process. These phases are:

- Power-On Self Test (POST), executed by the BIOS.
- SMC Device Driver Attachment (i.e. initialisation).
- SMC Client Loading.

The SMC Last Client sends a message to the SMC that it has loaded.

The NextBootStage variable can take values in the range 1000-FFFF. The most significant digits of this variable (i.e. the first three) are progress codes and are allocated as follows:

- **100-1FF** Diagnostic Processor and SMC
- **200-2FF** Motherboard BIOS
- **300-3FF** System Management Interface Card (SMIC) BIOS
- **400-7FF** Unallocated
- **800-8FF** Device Driver
- **900-EFF** Unallocated
- **F00-FFF** Last Client

The least significant digit (i.e. the fourth) indicates whether there is an error condition, according to the following scheme:

- **0** No error
- **F** Used by SMC to indicate an error

The following codes have special meaning to the SMC:

- **0001** is issued, accompanied by an alarm, under the following circumstances:
  - ◊ The nickel-cadmium battery on the SMC board has fully discharged. This will happen if the server is disconnected from the mains electricity for at least one month.
  - ◊ The SMC firmware which controls the Front Panel is updated.
  - ◊ A fatal error occurs on the SMC and the SMC executes a self-reset.

  This means that any changes you have made to the configuration settings within the SMA have been lost. Use the SMA to restore these settings (see the *SMA User's Guide* and the SMA's own on-line help system).
- **2000** must be issued by the BIOS when it starts execution before configuration testing has taken place.
- **7FF0** is the POST completion code. It is sent by the BIOS when the POST completes successfully. When the code is received, the POST watchdogs are disabled.
- **8FE0** is the code sent by the SMC Device Driver to indicate that it will be absent.
- **8FF0** is the code sent by the SMC Device Driver to indicate that it has initialised successfully.
- **FFE0** is the code sent by the SMC Last Client to indicate that all clients will be unloaded. The Trap generator is disabled.
- **0000** is the code sent by the SMC Last Client to indicate that all clients are now loaded. The Trap generator is enabled.

SMC-specific NextBootStage codes

Code	*Meaning*	*Source*
1000	Reset is issued to Diag-Processor	SMC
100F	POST has not started its execution. (SMC detected time-out)	SMC
1200	Shutdown_request is issued to S/W	SMC
1400	Normal Reset_request issued to S/W	SMC
1600	NMI request is issued to Diag-processor	SMC
1800	Dump (INIT) request is issued to Diag-processor	SMC
1FFF	System dead is reported by Diagnostic processor	Diagnostic processor
2000	POST has started its execution	POST
2001-2FFF	POST indicates the number or error of test being executed	POST
7FF0	POST completes its execution	POST
8FE0	Device driver is detached	Device driver
8FF0	Device driver is attached	Device driver
FFE0	Clients are detached	Last Client
0000	Clients are attached	Last Client
	This code also appears when a Reset or Shutdown has been cancelled by S/W.	Device drivers or clients

POST beep codes

Certain tests are performed before the video subsystem is initialised, thus requiring the speaker to emit beep codes in the case of a failure. The following table describes the various codes and their meaning.

Diagnostic code	*Number of beeps*	*Meaning*
02h	1-1-3	CMOS write/read test failure
03h	1-1-4	BIOS ROM checksum failure
04h	1-2-1	Programmable Interval Timer test failure
05h	1-2-2	DMA initialisation failure
06h	1-2-3	DMA page register read/write test failure
07h	1-2-4	RAM refresh verification failure
08h	1-3-1	First 64K RAM test failure
09h	1-3-2	First 64K RAM parity test failure
10h	1-3-3	Slave DMA register test failure
11h	1-3-4	Master DMA register test failure
12h	1-4-1	Master interrupt mask register test failure
13h	1-4-2	Slave interrupt mask register test failure
15h	1-4-4	Keyboard controller test failure
1Bh	2-2-2	Search for video ROM test failure
1Ch	2-2-3	Screen believed inoperable
20h	2-2-4	Timer tick interrupt test failure
21h	2-3-1	Interval timer channel 2 test failure
23h	2-3-3	Time-of -day clock test failure
27h	2-4-3	CMOS memory size against actual compare failure
28h	2-4-4	Memory size mismatch occurred

Example: Keyboard controller test fail, the speaker would emit one beep, pause, then four beeps, pause, then another four beeps, followed by a long silence. The beep pattern may then keep repeating. In most cases where beep codes are used, the failure is of a serious nature and the system is halted.

Other BEEP codes

There are a few other codes that occur, but please note that some are system beeps that will be heard during normal operation.

No beeps. If no beeps are heard at all the speaker may be disconnected or there may be a speaker circuitry fault.

One short beep. Marks the completion of POST and no functional errors found. You will also get a single beep if you press an invalid key for a power-on password.

Two short beeps. Indicates and draws your attention to an error during POST. This should be accompanied by an error code from the table below.

Three short beeps. System memory error, normally accompanied by code 201, but beeps are used when the video cannot display the code.

Continuous beep. Could indicate a serious failure of the system motherboard, or a failure of the speaker circuitry.

Repeating short beeps. Usually indicative of a keyboard key stuck down, but may be due to the keyboard interface failing.

One long and one short beep. POST has detected an error on the video adapter in the system. There may well be no display on the screen.

One long and two short beeps. This means that either the video subsystem is faulty or that a video I/O adapter ROM is not readable.

Two long and two short beeps. The video subsystem cannot be supported by the main system POST. This can occur when the video subsystem is replaced or changed on site.

POST codes (continued over)

Code	*Meaning*
0	Default config in use (last **3** boots failed)
101	Timer tick interrupt failure
102	Timer **2** test failure
106	Diskette controller failure
110	System board memory parity error
111	I/O Channel card error
114	Option ROM checksum failure
121	Unexpected hardware type **2** interrupt occurred
129	Internal cache error
151	Real time clock failure
161	Real time clock battery failure
162	CMOS RAM checksum failure
162	Invalid configuration information
163	Time of day not set
164	Memory size does not match
175	Bad EEPROM CRC**1**
176	System tampered, covers removed
177	Bad administrator password checksum
178	System tampered
182	EEPROM is not functional
183	Administrator password is needed
184	Bad power-on password checksum
185	Corrupted boot sequence
186	Hardware problem
188	Bad EEPROM CRC2
189	Excessive password attempts
201	Memory error
229	Internal cache error
262	DRAM parity configuration

Code	Meaning
301	Keyboard/keyboard controller failure
604	Diskette drive failure
605	Diskette unlocked problem
662	Diskette drive configuration
762	Coprocessor configuration
962	Parallel port configuration
1162	Serial port configuration
1762	Fixed disk configuration
1780	Fixed disk **0** failure
1781	Fixed disk **1** failure
1782	Fixed disk **2** failure
1783	Fixed disk **3** failure
1800	PCI- no more IRQ available
1801	PCI- no more room for option ROM
1802	PCI- no more I/O space available
1803	PCI- no more memory (above **1**MB) available
1804	PCI- no more memory (below **1**MB) available
1805	PCI- checksum error or **0** size Option ROM
1806	PCI-PCI bridge error
1962	No bootable device
2400	Display adapter failed, using alternate
2462	Video memory configuration error
5962	CD-ROM configuration error
8601	Pointer device failure
8603	Pointer device has been removed

Codes Generated by the SMIC BIOS

The following table contains codes that the System Management Interface Card (SMIC) BIOS generates during POST. The codes, which can appear on the LCD or within the System Management Application, define the start and end points of each action. The appearance of one of these codes does not indicate an error unless it flashes.

Start	Definition	End
3100	Boot control decision logic	3900
3110	Console redirect decision logic	3910
3200	Initialise FPSC communications	3A00
3210	Write inventory information	3A10
3220	Enable / Disable CPUs	3A20
3230	Fatal error handler	3A30
3240	Write inventory information	3A40
3300	Console redirection	3B00
3510	Ethernet card node address reporting	3D10

Start	Definition	End
3520	Time synchronisation	3D20
3530	Non-fatal POST errors reporting	3D30
3540	Security	3D40
3700	Flash Disk initialisation	3F00
3710	Flash Disk boot	3F10
3720	Flash Disk self-test	3F20

Codes that appear in the SMA

POST error codes and messages (continued over)

The BIOS indicates errors by displaying a message on the screen, which is preceded by the POST error code. The error code will also be logged to the SMC. As one of the final actions before POST is completed, the BIOS copies up to six POST error codes into variables in the range NonfatalPOSTError1 to NonfatalPOSTError6.

The following codes will appear inside the System Management Application (SMA) and not on the front panel LCD.

Code	Error Message
0002	Primary Boot Device Not Found
0010	Cache Memory Failure, Do Not Enable Cache
0015	Primary Output Device Not Found
0016	Primary Input device Not Found
0041	EISA ID Mismatch for Slot
0043	EISA Invalid configuration for Slot
0044	EISA config NOT ASSURED!
0045	EISA Expansion Board Not Ready in Slot
0047	EISA CMOS Configuration Not Set
0048	EISA CMOS Checksum Failure
0049	EISA NVRAM Invalid
0060	Keyboard Is Locked ... Please Unlock It
0070	CMOS Time & Date Not Set
0080	Option ROM has bad checksum
0083	Shadow of PCI ROM Failed
0084	Shadow of EISA ROM Failed
0085	Shadow of ISA ROM Failed
0131	Floppy Drive A:
0132	Floppy Drive B:
0135	Floppy Disk Controller Failure
0140	Shadow of System BIOS Failed
0170	Disabled CPU slot #
0171	CPU Failure - Slot 1, CPU #1
0172	CPU Failure - Slot 1, CPU #2

Code	Error Message
0173	CPU Failure - Slot 2, CPU #1
0174	CPU Failure - Slot 2, CPU #2
0171	Previous CPU Failure - Slot 1, CPU #1
0172	Previous CPU Failure - Slot 1, CPU #2
0173	Previous CPU Failure - Slot 2, CPU #1
0174	Previous CPU Failure - Slot 2, CPU #2
0175	CPU modules are incompatible
0180	Attempting to boot with failed CPU
0191	CMOS Battery Failed
0195	CMOS System Options Not Set
0198	CMOS Checksum Invalid
0289	System Memory Size Mismatch
0295	Address Line Short Detected
0297	Memory Size Decreased
0299	ECC ErrorCorrection Failure
0301	ECC Single bit correction failed, Correction disabled
0302	ECC Double Bit Error
0310	ECC Address Failure, Partition #
0370	Keyboard Controller Error
0373	Keyboard Stuck Key Detected
0375	Keyboard and Mouse Swapped
0380	ECC DIMM failure, Board in slot 1 DIMM #
0392	ECC DIMM failure, Board in slot 2 DIMM #
0430	Timer Channel 2 Failure
0440	Gate-A20 Failure
0441	Unexpected Interrupt in Protected Mode
0445	Master Interrupt Controller Error
0446	Slave Interrupt Controller Error
0450	Master DMA Controller Error
0451	Slave DMA Controller Error
0452	DMA Controller Error
0460	Fail-safe Timer NMI Failure
0461	Software Port NMI Failure
0465	Bus Timeout NMI in Slot
0467	Expansion Board NMI in slot
0501	PCI System Error
0510	PCI Parity Error
0710	System Board Device Resource Conflict
0711	Static Device Resource Conflict
0800	PCI I/O Port Conflict

Code	Error Message
0801	PCI Memory Conflict
0802	PCI IRQ Conflict
0803	PCI Error Log is Full
0810	Floppy Disk Controller Resource Conflict
0811	Primary IDE Controller Resource Conflict
0812	Secondary IDE Controller Resource Conflict
0815	Parallel Port Resource Conflict
0816	Serial Port 1 Resource Conflict
0817	Serial Port 1 Resource Conflict
0820	Expansion Board Disabled in Slot
0900	NVRAM Checksum Error, NVRAM Cleared
0903	NVRAM Data Invalid, NVRAM Cleared
0905	NVRAM Cleared By Jumper
0982	I/O Expansion Board NMI in Slot
0984	Expansion Board Disabled in Slot
0985	Fail-safe Timer NMI
0986	System Reset Caused by Watchdog Timer
0987	Bus Timeout NMI in Slot

APPENDIX

Anti-static precautions

Static electricity can cause permanent damage to electronic components. You should be aware of this risk, and take precautions against the discharge of static electricity into the computer.

Static electricity can be generated by moving on a chair, brushing against desks or walls, or simply walking across an ordinary carpet. Items handed from one person to another, or being wrapped or unwrapped, can acquire a static charge. Air conditioning systems can also result in very high levels of static.

Clothing made of synthetic fibres is particularly likely to generate static electricity. Static electricity is often completely unnoticed by the wearer, but can be sufficient to cripple or destroy sensitive electronic components in computers.

The computer is especially at risk from static discharge while the covers are removed, as the electronic components of not only the motherboard, but all other boards are exposed. Memory modules are specific examples of electrostatic sensitive devices (ESSDs).

All work that involves removing the covers must be carried out in an area completely free of static electricity. We recommend using a Special Handling Area (SHA) as defined by EN 100015-1: 1992. This means that working surfaces, floor coverings and chairs must be connected to a common earth reference point, and you should wear an earthed wrist strap and anti-static clothing. It is also a good idea to use an ioniser or humidifier to remove static from the air.

- When installing any upgrade, be sure you understand what the installation procedure involves before you start. This will enable you to plan your work, and so minimise the amount of time that sensitive components are exposed.
- Do not remove either the system unit covers, nor the anti-static bag or wrapping of any upgrade, until you need to.
- Handle static-sensitive items with extreme care. Hold expansion cards and add-on components only by their edges, avoiding their electrical contacts. Never touch the components or electrical contacts on the motherboard or on expansion cards. In general, do not handle static-sensitive items unnecessarily.
- Keep all conductive material, foodstuffs and especially liquids, away from your work area and the open computer.

Note

The rear panel of the server has an earthing stud available for use during service work.

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