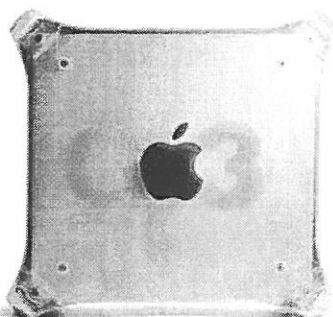


ACSE Update 1999 Power Mac G3



Notes

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Contents

- Architecture
- Technologies
- Support Items
- Service Items
- Disassembly

2

Notes

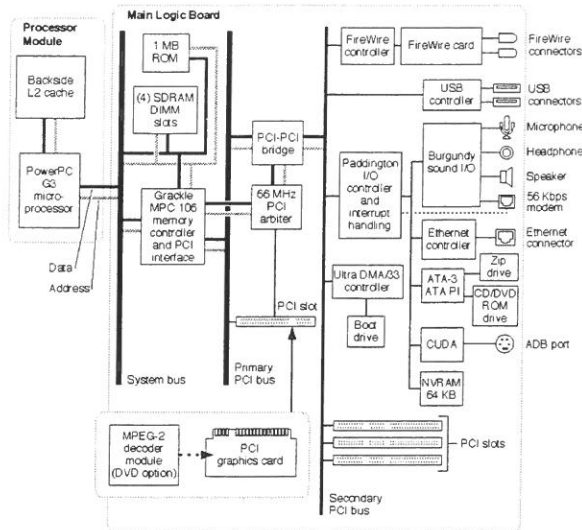
Architecture

In this chapter we will discuss

- the hardware architecture of the G3 Blue and White
- the main features and specifications of the G3
- the version of System Software needed for the G3

Architecture

- 100 MHz system bus
- 66 MHz PCI
- 64 bit PCI
- FireWire



Notes

Architecture

The architecture of the main logic board is based on the PowerPC G3 microprocessor and three buses: the processor bus and two PCI buses, a primary 32-bit 66 MHz bus and a secondary 64-bit 33 MHz bus. The processor bus connects the microprocessor, cache, and main memory; the primary PCI bus is for an Apple graphics card solution; the secondary PCI bus connects the I/O devices. The I/O devices on the secondary PCI bus are:

- Ultra DMA/33 (ATA-4) disk interface
- USB interface
- FireWire interface
- Paddington I/O controller IC
- PCI 33.33 MHz 64-bit slots B (2), C (3), and D (4)
- DEC/Intel 21154 PCI-PCI bridge IC

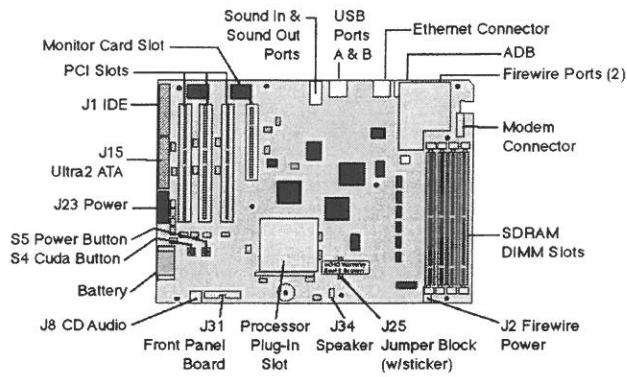
More Information

Developer Note at <http://developer.apple.com/techpubs/hardware/hardware.html>

Technical Information guide at <http://tilsp.info.apple.com/techinfo.nsf/artnum/n24213>

Logic Board

Logic Board Diagram



Notes

Logic Board

This is a diagram of the logic board of the G3 with a description of all the components and connectors.



Technologies

Notes

Technologies

In this chapter we will discuss

- Open Firmware booting
- 64 bit and 66 MHz PCI technology
- 3D Graphics
- Connections
 - USB
 - FireWire
 - Ultra ATA
 - Ultra2 SCSI

Open Firmware Booting



Mac OS ROM

- Old ROM is now split into two parts:
 - Boot ROM (~1MB)
 - Mac OS ROM file in System Folder (~3 MB)
- Open Firmware
 - 'Mini OS' for initializing the Mac, independent of the OS to be loaded
 - Device Tree

```
Open Firmware, 1.0.5
To continue booting the Mac OS type:
BYE<return>
To continue booting from the default boot device type:
BOOT<return>
ok
```

6

Notes

Open Firmware: Definitions

Open Firmware is the process that controls the microprocessor after hardware initialization and diagnostics have been performed, but before control is passed to the main Operating System. Among other things, it is responsible for building the device tree and probing the expansion slots for I/O devices. Open Firmware queries PCI devices for their address space needs and dynamically assigns this space to each device. It is during this probing process that each device and motherboard ASIC is given a node in the device tree. Open Firmware drivers are special device drivers that operate in the Open Firmware pre-boot environment, and, unlike most drivers, are processor-independent, which means that they will work with any type of CPU—Intel, PowerPC, Alpha, SPARC—provided the host computer supports Open Firmware.

Nodes, which are also called **packages**, contain **properties** and **methods**. Properties are attributes that describe the hardware and driver. **Methods** work in much the same way as subroutines or procedures. The hardware and software engineer can use the Open Firmware user interface to debug their devices and drivers respectively. *See Technote 1044, Understanding PCI Expansion Choices for Mac OS 8, Part III of the Open Firmware Technote Series, for details about properties and methods for various devices.*

Forth is the human interface language to Open Firmware and the device tree. If you're a board designer, you'll want to read and write registers on your device directly, and, therefore, must be able to move through all of the device tree and to insert and delete words, etc. The driver writer has similar needs and must also build an **FCode** representation of the driver properties and methods. If the device contains a boot driver, that driver must be debugged with the Open Firmware user interface.

A **boot driver** is written in Forth, then tokenized into FCode and debugged from the interface. This form of driver is used during the earliest stages of the boot process before an operating system is available. Typical boot drivers are display, keyboard, network, and block drivers, but are not limited to these.

The Open Firmware user interface, therefore, as specified by the **IEEE1275-1994 Specification**, is required to allow board designers and driver writers access to their hardware and software to build and debug their expansion device project.

More Information

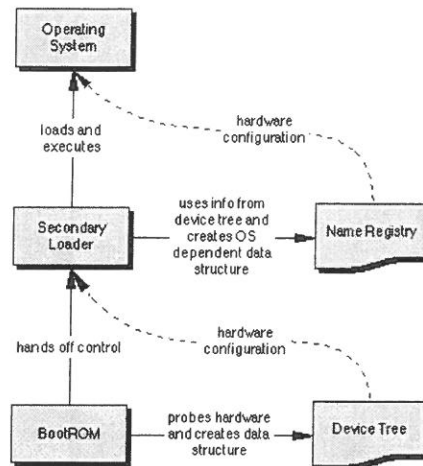
technotes: <http://developer.apple.com/technotes/tn/tn1044.html> , [tn1062.html](http://developer.apple.com/technotes/tn/tn1062.html) and [tn1061.html](http://developer.apple.com/technotes/tn/tn1061.html)

Open Firmware HomePage: <http://playground.sun.com/1275/home.html>

Open Firmware usersguide: <http://www.linuxppc.org/userguide/of.html>

Open Firmware

- Used since PCI Power Mac
- CHRP compliant (3.0)
- 'New World' Boot Process
 - POST
 - Open Firmware, device tree
 - Toolbox ROM image file, PRAM into reserved RAM
 - Start nanokernel
 - Start 68K emulator
 - Boot Mac OS



Notes

NewWorld Boot Process (codename for process used in iMac and G3 Blue & White)5

The following is a high-level overview of the execution path take when a NewWorld-based computer boots.

1. The POST code runs (preliminary diagnostics, boot beep, initialization, and setup), with possible intervention in the Mini Nub.
2. Open Firmware initializes and begins execution, including the building of the device tree and the interrupt trees;
3. Open Firmware loads the Toolbox image file, based on defaults and NV-RAM settings;
4. Open Firmware executes the Forth script in the bootinfo file, which contains instructions to read both the Trampoline code and the compressed ToolBox ROM Image and give them a temporary place in memory;
5. The Forth script transfers control to the Trampoline code, which functions as the transition between Open Firmware and the start of the Mac OS execution;
6. The Trampoline code decompresses the ToolBox ROM Image, gathers information about the system from Open Firmware, creates data structures based on this information, terminates Open Firmware, and rearranges the contents of memory to an interim location in physical memory space;
7. The Trampoline code transfers control to the HardwareInit routine in the ToolBox ROM Image;
8. The HardwareInit routine copies data structures to their correct places in memory, and then calls the NanoKernel;
9. The NanoKernel fills in its data structures and then calls the 68K Emulator;
10. The 68K Emulator initializes itself, then transfers control to the startup initialization code;
11. The startup initialization code begins execution, initializing data structures and Managers and booting the Mac OS.

All functions found in the old ToolBox ROM are present in the NewWorld boot process, but occur at different times and places. To accomplish this, the code in the ToolBox ROM Image and POST is simplified, while the Trampoline code addresses the new functionality.

More Information

http://service.info.apple.com/secure/technical.resources/training/service_imac/Support/support5.html

Open Firmware Exercise

- Required materials
 - iMac or B&W G3
 - Print of Open Firmware User's Guide
 - <http://www.linuxppc.org/userguide/of.html>
- Purpose
 - To get a feeling of Open Firmware
 - To learn basic commands for booting the Mac OS

8

Notes

Exercise

Boot the iMac while pressing the COMMAND - OPTION - O - F keys

You will see a white screen displaying text such as the following (details may differ depending on model and version):

```
Apple iMac Open Firmware 3.0 f3 Built on...
Copyright 1994-1998 Apple Computer
All rights reserved
ok
0>
```

Type '`dev / ls`' (please note the spaces)

This will display a list of all devices in the Mac sorted by connection.

Compare this list with the Architecture Block Diagram. You can see that the USB controller is connected to the PCI bus directly. You will also be able to see devices in the list that are not actually in the Mac (like a SCSI tape device on the iMac).

Type '`printenv`'

This will display a list of NVRAM (PRAM) settings.

Feel free to use other commands from the Open Firmware User Guide.

Type '`bye`' or '`mac-boot`' (depending on settings and version of Open Firmware) to boot the Mac OS.

If this fails, try '`shut-down`'.

64 bit PCI

	Bit	MHz	MB/s
PCI	32	33	133
64 bit PCI	64	33	266
Video slot	32	66	266
NuBus	32	10	40

9

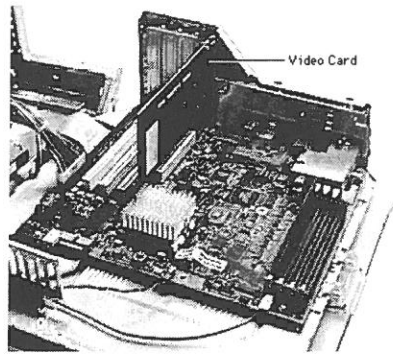
Notes

Peripheral Component Interconnect (PCI)

The Power Macintosh G3 computer includes four PCI expansion slots. Three of the slots are 5V, 64-bit, 33 MHz slots that support both 32-bit and 64-bit PCI cards that are compliant with the PCI V2.1 specification. The other slot, is a 3.3V, 32-bit, 66 MHz slot dedicated to a 2D/3D accelerated graphics card. The 66 MHz PCI slot conforms to the PCI V2.1 specification with the exception that its clock speed is fixed at 66 MHz, so it does not accept 33 MHz cards. The 66 MHz PCI slot is keyed for 3.3V only operation. Older 5V cards cannot be installed in the 66 MHz PCI slot. The 3.3V 66 MHz PCI graphics card that comes installed in the 66 MHz PCI slot cannot be used in one of the 33 MHz PCI slots.

66 MHz PCI

- Video only
- Contains ATI 3D RAGE 128 GL card
- AGP-like



10

Notes

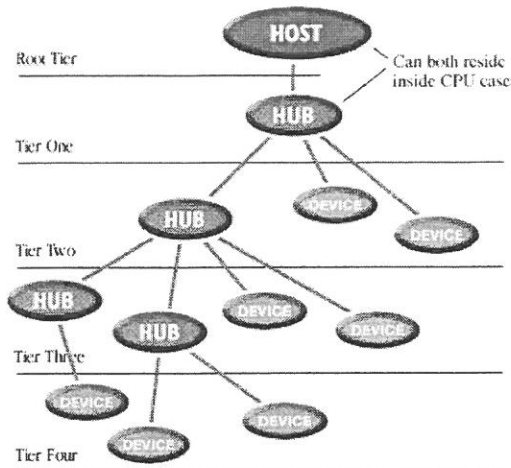
66 MHz PCI slot

There is one 66 MHz PCI slot, which is occupied by the ATI video card. This card is only supported in this slot, and other cards are (not yet) supported in this slot.

The technology is related to the AGP used in Wintel PCs, but not the same.

USB

- 12 Mbit/s (1.5)
- 127 devices
- Hot pluggable
- Max 5m & 5 hubs



11

Notes

USB Connectivity Rules

USB Connectivity Rules

These are the rules for USB connectivity:

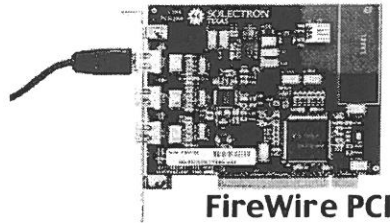
- The maximum number of devices that can be connected to a single USB hub is 127 devices. (Note: A keyboard with a built-in trackball counts as two devices.)
- The maximum number of tiers allowed is six. This can be tricky to track sometimes, since hubs can be hidden in CPU cases, displays, keyboards, etc.
- Bus-powered hubs cannot be connected to bus-powered hubs due to power limitations. A keyboard with an internal hub is a good example of a bus-powered hub
- The maximum cable length allowed for 12 Mbps devices is 5 m, and this cable must be shielded. The maximum cable length allowed for 1.5 Mbps devices is 3 m; the cable is typically unshielded.

•More Information

- <http://developer.apple.com/dev/usb/>

FireWire (IEEE 1394, iLink)

- 400Mbps and up
- Hot pluggable
- No device ID's
- 5 m cables are simple
- 63 devices on bus w/max 16 serial hops
- Isochronous and asynchronous data transfer
- Mac to Mac and Mac to PC
- FireWire 2.0 Update
 - Hard disk support



12

Notes

FireWire

FireWire is a new high-speed serial I/O technology that is very fast, easy to use, and optimized for multimedia. It is the industry standard 1394 interface invented by Apple and supported by Microsoft and Intel. With speeds of 400Mbps, FireWire is great for moving digital video into and out of the Macintosh—DV streams can run from 25-30 Mbps. This technology is complementary to USB which is targeted at keyboards, mice, and other low speed I/O devices.

In addition to speed, which will be doubling again over the next few years to 800 and 1,600Mbps, FireWire is the most convenient I/O system ever devised. It is fully hot pluggable, does not use device IDs or terminators like SCSI, allows for long 14 " cables and up to 63 devices on a bus (including other computers). Its isochronous data mode guarantees that time-sensitive data like audio and video will arrive on time even while other data traffic moves across the bus.

iLink is the name SONY uses for the same technology.

FireWire 2.0 Software

Apple's FireWire 2.0 software is a component of the Mac OS that supports the IEEE 1394 High Performance Serial Bus standard. FireWire 2.0 provides a system extension called FireWire Support. This extension adds services to the Mac OS to support the use of FireWire hardware and software.

FireWire 2.0 also provides an extension called FireWire Enabler. This extension adds hardware-specific support for Apple FireWire interfaces. The FireWire Enabler extension only supports the Apple FireWire PCI Card and the built-in FireWire interface on blue and white Power Macintosh G3 computers.

FireWire 2.0 can improve the quality of video recorded from blue and white Power Macintosh G3 computers to DV devices. FireWire 2.0 also contains new services that enable the use of FireWire disk drives, printers, and other new devices.

The FireWire 2.0 installer can only be used on Power Macintosh G3 computers.

More Information

FireWire at Apple <http://www.apple.com/FireWire>

FireWire for Developers <http://developer.apple.com/hardware/FireWire/>

FireWire 2.0 software <http://asu.info.apple.com/swupdates.nsf/artnum/n11316>

Ultra ATA

- Part of the EIDE, ATA, and ATAPI family
- Only 1 Ultra ATA drive is supported in the G3 B&W
 - CD-ROM and ZIP are on ATA-3 channel

Transfer modes	PIO 1	PIO 3,4 DMA 0,1,2	PIO 3,4 DMA 0,1,2	PIO 3,4 DMA 0,1,2 Ultra DMA
Transfer rate (MB/s)	4	16	16	33

13

Notes

Ultra ATA

The ATA bus was first used in the IBM AT PC's (ATA = AT Attachment) and subsequently developed into IDE, Enhanced IDE, and the ATAPI interface (mostly used on notebooks) and now Ultra ATA.

The mode of transfer is PIO1 to 4 or DMA:

PIO = Programmed Input Output

DMA = Direct Memory Access

Both technologies are developed to create a fast transfer of data from the disk to the memory.

DMA enables the drive controller to access the memory directly, while in PIO mode the processor (and not the drive controller) controls this transfer.

Ultra ATA Drives

The Power Macintosh G3 accommodates one internal ATA device in the lower drive carrier. If the Power Macintosh G3 model has an Ultra ATA drive, the drive sits in the rear of the carrier in position number 3.

ATAPI CD-ROM Drive: the Power Macintosh G3 computer has a 24-speed internal ATAPI CD-ROM drive. The CD is configured as device 0 (master) in a ATA Device 0/1 (master/slave) configuration.

Optional ATAPI Zip Drive

The Zip drive is an ATAPI drive and is connected as device 1 (slave) in an ATA Device 0/1 (master/slave) configuration on the ATA-3 channel of the main logic board.

More Information

Quantum White paper on Ultra ATA <http://www.quantum.com/src/whitepapers/ultraata/>

Ultra2 SCSI

- LVDS Low Voltage Differential SCSI
- 40 (narrow) or 80 MB/s (wide)
- 12 m max cable length
- NOT 100% compatible with older SCSI
 - (fast, wide, ultra wide, etc. are single-ended SCSI)

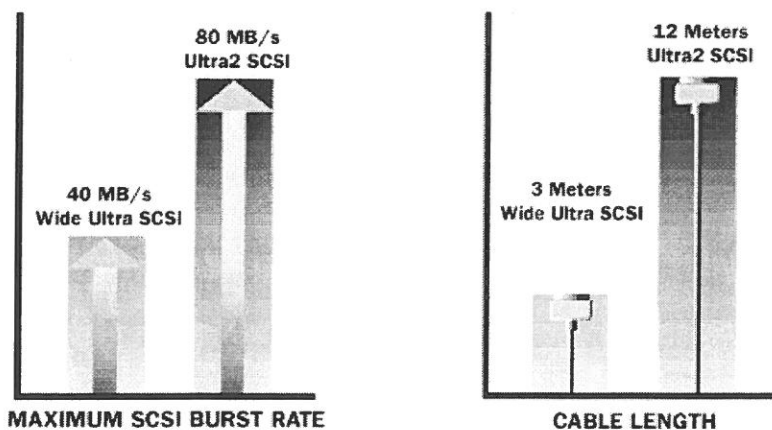
SCSI - 1	SCSI - 2	SCSI - 3	Ultra2
Original SCSI Standard	Revision 2 SCSI-1	Revision 2 SCSI-2	Subset of SCSI-3
Any / Sync 8-bit (narrow) 5 Mbytes/sec	Differential 16-bit (wide) FAST SCSI 20 Mbytes/sec	Ultra 40 Mbytes/sec	LVD 80 Mbytes/sec
1980-1985	1986-1992	1993-1998	1995-1998

14

Notes

More Information

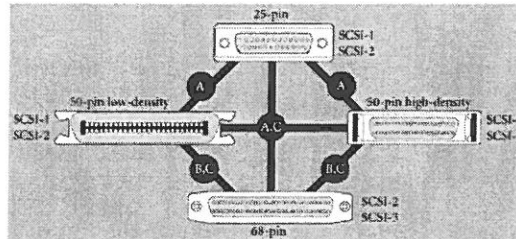
Quantum Whitepaper on Ultra2 http://www.quantum.com/src/whitepapers/ultra2_TIP.html



Type of SCSI	Max. Transfer Rate (MBps)	Max. Devices	Max. Cable Length	Connector Types Used
SCSI-1	5	7	3 meters	25-pin 50-pin Centronics
SCSI-2 (Fast)	10	7	3 meters	50-pin high density 50-pin standard 50-pin Centronics
Ultra Narrow	20	7	1.5 meters	50-pin high density 50-pin standard 50-pin Centronics
Ultra Wide	40	15	1.5 meters	68-pin high density
Ultra2 LVD	80	15	12 meters	68-pin high density

SCSI Connectors

- Narrow:
 - DB-25 (Apple Mac)
 - 50 pin LD (Apple devices)
 - 50 pin HD (others)
- Wide:
 - 68 pin HD (all)



15

Notes

Common SCSI connectors

See the picture on the right and the notes below.

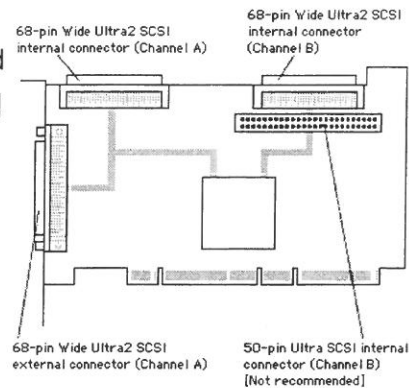
- The DB-25 connector uses a reduced number of grounds for a smaller size. Communications through this connector occur at SCSI-1 speeds.
- Communications between these two devices will be at the slower (non-wide) speed. The speed for other devices is not affected.
- When connecting 50-pin or 25-pin devices to a 68-pin (wide) device, the extra 18 pins must be terminated.

Speed

- A pair of devices will communicate at the speed of the lowest device.
- This chart shows which adapters or adapting cables are necessary to connect SCSI devices. All SCSI devices are compatible with each other except for differential, low-voltage differential, and single-ended.
- You cannot mix differential, low-voltage differential, and single-ended devices on the same bus.
- Do not use differential termination with a single-ended device (or vice-versa).

Ultra SCSI Cards

- Single Channel SCSI Card
 - Ultra 2 - 80 MB/s
 - Firmware Update required
- Dual Channel SCSI Card
 - Dual Ultra2 - 80 MB/s
- Ultra SCSI PCI Card
 - Ultra (Narrow) - 20 MB/s



16

Notes

Apple Cards

Apple sells three types of SCSI cards for the G3.

NOT ALL TYPES ARE AVAILABLE IN EACH COUNTRY.

Single Channel SCSI Card

Ultra 2 - 80 MB/s

Dual Channel SCSI Card

Dual Ultra2 - 80 MB/s

Ultra SCSI PCI Card

Ultra (Narrow) - 20 MB/s

Specifications for all cards:

TIL article 58204 : Power Macintosh G3 (blue and white) SCSI FAQ.

Connector overview Ultra2 LVD SCSI Card

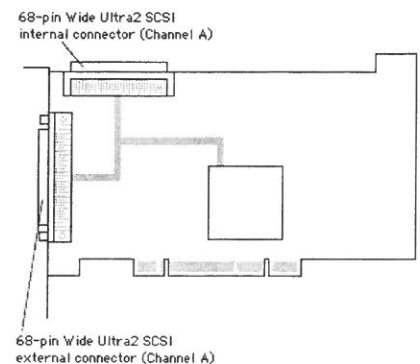
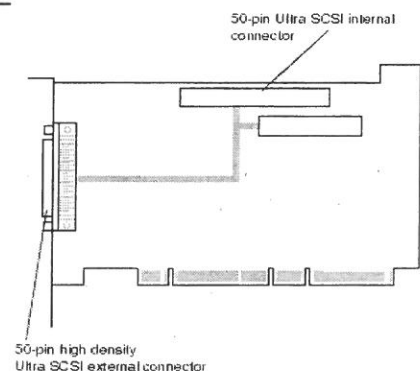
see TIL article #58280.

About the Ultra2 SCSI Card Firmware Update

<http://asu.info.apple.com/swupdates.nsf/artnum/n11317>

If your (blue and white) Power Macintosh G3 or Macintosh Server G3 came with a single channel Ultra2 low voltage differential (LVD) SCSI card, run this updater to install firmware on the card that will yield more stable system performance.

The new firmware is necessary to correct occasional problems related to cable termination that can occur when internal and external hard disk drives are connected to the card.



Single Ended - Differential SCSI

- Single Ended: One signal cable, one ground
- Differential: Two signal cables; each is a mirror of the other
 - Interference acts on both cables, while the difference remains the same, thus longer cables are possible
- LVDS needs different terminators; always use active termination
 - SCSI-1, Fast, and Ultra (narrow & wide) use single ended
 - Ultra2 uses differential

17

Notes

Single-ended

Single-ended cable configurations are common industry-wide because they are less expensive and quite adequate for slower speeds and short cable length systems. However, single-ended devices rely on tight termination tolerances. Going beyond this narrow margin of error can cause problems.

In a single-ended configuration, signals on a cable are identified according to the voltage of a single wire (up to 5 volts) relative to a common ground (0 volts). A signal line is recognized as asserted (true) or deasserted (false) according to the strength of its signal and whether it is active high or active low.

NOTE: All SCSI signals are active low.

Active low signals are deasserted (false) when the signal strength is above a certain voltage, which is typically over 2.0 volts. Active low signals are asserted when the voltage falls below a stated level, which is typically under 0.7 volts. Windows of error may occur if the bus misinterprets a signal that is close to the cutoff.

SCSI buses using the single-ended bus technology provide high-speed communication for short distances. The longer the cable, the more likely errors may be introduced into the signal.

Differential

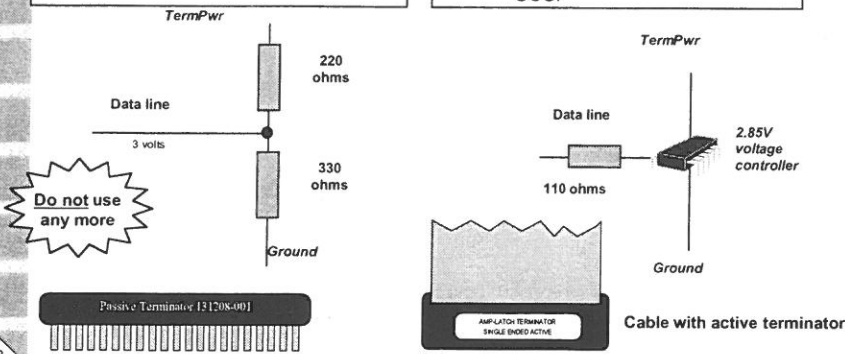
In a differential cable configuration, the same information is sent with opposite voltages simultaneously through two sets of wires. The information is interpreted by the difference in voltage between the wires. When noise interferes with the signal in this bus configuration, both wires are affected equally. Since the noise level on both wires is the same, the difference in voltage is unchanged. This allows the device to receive information free of noise.

A differential cable configuration determines signals by contrasting the voltage difference between two wires. This has the advantage of allowing cable lengths up to 25 meters (about 80 feet). It is mainly intended for connecting devices externally. Differential configurations are much less subject to signal noise and other termination problems than single-ended configurations.

Differential cabling requires more powerful drivers, which in turn require additional chips (two for narrow and three for wide). The peripheral device and the SCSI controller card must be designed to use a differential configuration. For these reasons, systems that use a differential electrical specification are less popular than single-ended configurations. However, the need for increased speeds is expanding the popularity of differential configurations.

SCSI Termination

- Passive termination
 - Uses resistors
 - Not for Fast or Ultra SCSI
- Active termination
 - Uses a voltage regulator
 - Required for Fast and Ultra SCSI



Notes

SCSI Termination

The SCSI bus must be terminated at both ends. Fast and Ultra SCSI requires active termination. The old passive method using a handful of resistors does not work at higher signal rates.

Sometimes an incorrectly terminated bus seems to work. But beware! This may destroy data.

TERMPWR

TERMPWR is a 5 volts signal used to power the termination logic. Usually it is the controller who is in charge of delivering this voltage.

3D Graphics

- 2D : resolution x number of colors = amount VRAM
 - 1024 x 768 x 256 colors (8 bit, 1 Byte) = 768 kB needed
- 3D popular additions
 - Z-buffer
 - Texture buffer
- 3D Display technologies/languages
 - QuickDraw 3D
 - OpenGL
 - DirectX
- Games 3D is not professional 3D
 - 640x480 instead of 1024x768

19

Notes

3D Graphics

3D graphics cards tend to have lots of memory (the ATI card has 16 MB) while only 2 or 4 MB is needed to display high resolutions with millions of colors. The rest of the memory is used for the Z-buffer, Texture buffer or other buffering, depending on the type of card.

Z-buffer

This provides storage for the third dimension data (X, Y and Z axes).

Texture buffer

The Texture buffer is used for texture mapping. This is a technique by which a predefined image (the texture) is mapped onto the surface of an object in a model.

QuickDraw 3D

QuickDraw 3D is a system extension for creating, manipulating, rendering, and sharing 3D graphics. It consists of human interface guidelines and a toolkit, a 3-D file format, a high-level geometry engine, shading and rendering architecture, and a device and acceleration manager for hardware acceleration.

OpenGL

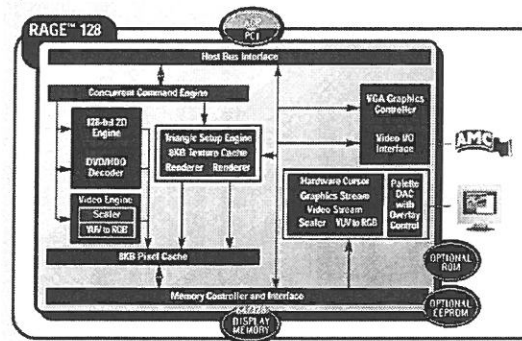
This is a competitor technology for controlling 3D graphics. Apple has committed to support OpenGL in the future. Is the most popular technology in high-end graphical software

DirectX

A competitor technology for controlling 3D graphics from Microsoft. It is very popular for low-end graphics and Windows games.

ATI 3D RAGE 128 GL card

- 16 MB VRAM
- 3D acceleration for QuickDraw 3D
- DVD/MPEG2 Option Module



Notes

DVD-ROM and DVD MPEG2 Decode Card Module

The DVD-ROM drive configuration includes a DVD MPEG2 decode card module. The DVD MPEG2 decode card module supports the display of DVD video movies on a monitor connected to the 15-pin video output port on the PCI 2D/3D accelerated graphics card. DVD digital audio from the DVD media is sent to a DAC (digital-to-analog converter) and then to the Burgundy IC for analog stereo sound output to the selected sound output port.

Fast Ethernet

- Autosensing 10 or 100 Mbit
- Full duplex if possible
- Apple System Profiler 2.1.2
 - Connection speed and half or full duplex visible

Network overview

Ethernet	Link: up	Speed: 10 Mbps	Duplex: half
Open Transport	Installed: Yes	Active: Yes	Version: 1.3
▶ AppleTalk	Installed: Yes	Active: Yes	Version: 60
▶ TCP/IP	Installed: Yes	Active: Yes	Version: 1.3

21

Notes

Full duplex, what is it?

Normally, Ethernet uses one pair for sending information, the other pair for receiving information. While sending the first 64 bits of a frame, the Ethernet card is also listening to detect collisions. This mode is called half duplex; only one Ethernet card in the collision domain is sending, the rest are listening.

If you are sure that it is impossible to have collisions (i.e. the collision domain consists of two devices; in case you are connected to a switch or if you connect 2 Macs by means of a cross-cable) the Ethernet card does not have to listen for possible collisions, and can send and receive at the same time; thus doubling the maximum throughput to 20 or 200 Mbit/sec (assuming there is simultaneous two-way traffic).

The Ethernet cards in the iMac and G3 automatically switch over to full duplex mode.

Support Items

22

Notes

Support Items

In this chapter we will discuss

- System Software installations
- Software updates
- Internet connections
- Support Items
- Support notices

System Software

- Mac OS 8.5.1 + Mac OS ROM file
 - Enabler merged with Mac OS ROM
- DVD Software
- ATI extensions
- USB Drivers included
 - Superdrive
 - Keyboard, Mouse



23

Notes

Question:

Is it true that the enabler is now built into the software ROM? What OS will Power Macintosh G3 use?

Answer:

Yes, the enabler is now merged with the Mac OS ROM file, so there is no longer a stand-alone enabler. The Power Macintosh G3 OS is 8.5.1 based with modifications for the hardware

Support Issues

- SuperDrive: Software included is too old.
 - Use G3 Installation CD (Extra's) or drivers from the Web
- If second graphics board is installed, this may be seen as the default: the ATI Card will not display an image
- USB Extender cables may cause freezes, etc.
 - Replace them if USB works without extender

24

Notes

SuperDrive Software error

Attempting to install the Imation Superdisk drivers from the included CD will generate a dialog box stating "This program cannot run on your computer. See the documentation for more details."

The version of the driver on the CD works fine on the iMac but will not install on the Power Macintosh G3 (Blue and White). Imation has posted an updated driver which can be downloaded from their web site at http://www.superdisk.com/sc/sc_dl.html

The Power Macintosh G3 (Blue and White) is shipped with the Imation drivers pre-installed, so there is no need to run the install program prior to use. If you need to reinstall the drivers, download the latest version from Imation.

ServN99 11 - Power Macintosh G3 Blue and White USB extender cable

In a few cases, customers can experience intermittent USB keyboard and mouse behavior when using the USB extender cable to extend the distance between the computer (Power Macintosh and Macintosh Server G3 Blue and White) and keyboard (e.g. tower on floor; keyboard & mouse on desk).

The mouse may appear frozen and the keyboard non-responsive. If the USB extension cable is not used, no problems are observed. When a customer experiences the above symptoms on a Power Macintosh or Macintosh Server G3 Blue and White, AASP should:

- 1- Verify that the USB keyboard and mouse behave normally when connected directly to the computer,
- 2- Then replace the customer USB extender cable (Service Part Number 922-3677).

The extender cables can be identified by means of the number printed on one of the USB connectors:

- Suspect extender cables: 590-2244
- Correct extender cables: 590-2282

Support Issues 2

- Cannot Boot from a RAID Striped Volume
 - Use small normal or mirror boot volume
- Cannot Boot from USB or FireWire devices (Zip, SuperDrive)
 - Only keyboard and mouse USB drivers in BootROM
- Forced restart with CMD-CTRL-ON not available
 - Use power or reset buttons
- Not possible to boot from SCSI Hard Disk
 - Some cards do not support booting

25

Notes

Not booting from striped volume

With the release of the iMac and later computers, Apple moved to a new Mac OS ROM architecture. This new architecture does not recognize multiple striped devices as a valid startup disk.

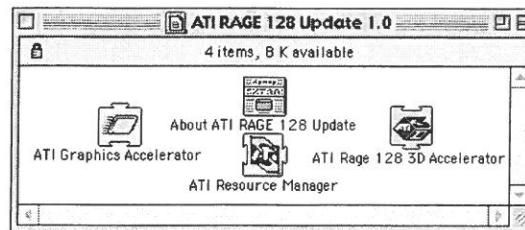
One workaround could be to create 2 different volumes where one of which is either standard or mirrored (the startup volume) and the other is striped (the storage volume). One would do this as follows: from within SoftRAID create a small Standard or Mirrored volume (big enough to store a System Folder as your startup volume).

Forced restart by CMD-CTRL-ON not available

If your computer freezes while you're working, try pressing the Power button on the front of the computer to shut down the computer. Then after the computer shuts down, press the Power button on the Apple USB keyboard or on the front of the computer to start up the computer. (The Control/Command/Power key combination used in earlier Macintosh computers is not available.) If that doesn't work, press the Reset button on the front of the computer. Your computer should restart. For more information, see the Troubleshooting Handbook that came with your computer.

Software updates

- ATI RAGE 128 Update 1.0
- FireWire Update 2.0
- Ultra2 SCSI Card Firmware Update 1.1
- Drive Setup 1.7.2
 - 1.7 adds support for ATA-4 (Ultra 33)
 - 1.7.2 bug fixes
 - All drives should be updated with 1.7.2



Notes

ATI Rage 128 Update for the Power Macintosh G3 (Blue and White) computer.

This software was released by Apple on 8 February 1999 and is available for downloading from Apple Software Updates Online. Please see Software Updates Document Number 11262, or use the following URL to access the article directly: <http://asu.info.apple.com/swupdates.nsf/artnum/n11262>.

Description: the files included in this update provide improved 2D and 3D acceleration for the ATI RAGE 128 graphic accelerator card shipping in the new Power Macintosh G3.

FireWire 2.0 Update

See the FireWire page for a description of this update.

Ultra2 SCSI Card Firmware Update

See the Ultra2 SCSI page for a description of this update.

Improvements to Drive Setup (version history)

- Version 1.7.2. Dim Low Level option when ATA drives are selected.
- Version 1.7.1. Addressed a Mode Page issue with certain SCSI hard drives.
- Version 1.7. Added Ultra DMA 33 support to ATA drives. Disabled Low Level option for ATA drives.
- Version 1.6.2. Fixed a potential problem with updating the drive on a fragmented Partition Map. Added Large Volume patch to all hard drives.
- Version 1.6.1. Fixed a potential data transfer problem on the PowerBook 5300 and PowerBook 2300 operating in SCSI Disk Mode.
- Version 1.6. Fixed a problem where ATA drives did not properly sleep. Also fixed a problem where Media bay devices were not properly reported on PowerBooks.
- Version 1.5. Added support for Power Macintosh G3 computers. Fixed a problem where the write cache on some ATA drives was disabled following a restart.
- Version 1.4. Added support for Mac OS Extended format for Mac OS 8.1. Supports all Macintosh computers that are supported by Mac OS 8.1 as well as all computers supported by Drive Setup version 1.3.x.
- Version 1.3.1. Fixed a problem on ATA drives that in rare cases could cause the loss of files/hard drive after a shutdown with Mac OS 7.6.1 and 8.0 systems.

Service Items

27

Notes

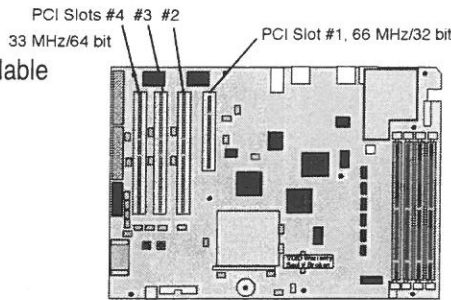
Service items

In this chapter we will discuss

- Memory expansion of RAM and VRAM
- Disassembly
- Service Notices
- Service Tools required

Expansion Slots

- 1 32 bit/66 MHz
 - Video
- 3 64 bit/33 MHz PCI slots
 - backwards compatible with 32 bit/33 MHz PCI
- 4 slots not enough?
 - PCI expanders available
 - Magma
 - Bit3
 - Second Wave



Notes

PCI Expansion Slots

The logic board uses the industry-standard peripheral component interconnect (PCI) bus for an I/O expansion bus. The Power Macintosh G3 has a primary 66 MHz bus and a secondary 33 MHz PCI bus. The 66 MHz bus is a 32-bit multiplexed address and data bus. The 33 MHz bus is a 64-bit multiplexed address and data bus.

The primary PCI bus includes slot #1 (see illustration) which accommodates only 32-bit 66 MHz +3.3V PCI cards. However, the Power Macintosh G3 computer is always configured with an Apple 2D/3D accelerated graphics card installed in slot #1, therefore it is not available for PCI card expansion unless the card is removed.

The secondary PCI bus includes slots #2, #3, and #4, (see graphic below) which accommodate both 32-bit and 64-bit 33 MHz +5V or 3.3V PCI cards. The logic board accepts standard 6.88-inch and 12.283-inch PCI cards as defined by the PCI Local Bus Specification, Revision 2.1. PCI cards are required to use the standard ISA fence described in the specification.

The PCI slots support all the required PCI signals and certain optional PCI signals. The three 33 MHz PCI slots on the logic board support the optional 64-bit bus extension signals and cache support signals.

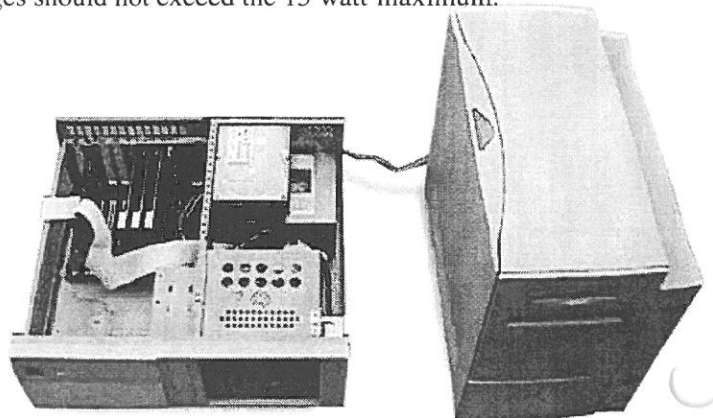
A total of 15 watts of power is provided for each of the PCI expansion slots. Both 5 volts and 3.3 volts are supplied; the total power consumed by both voltages should not exceed the 15 watt maximum.

PCI Expanders

<http://www.magma.com/pci/home.htm>

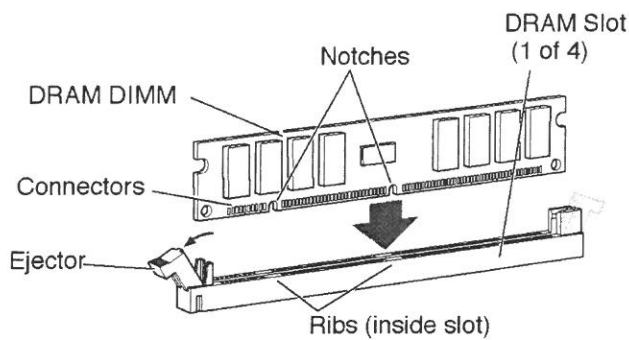
<http://www.2ndwave.com/products/xpansion.html>

<http://www.bit3.com/bit3/products/index.asp>



Memory Expansion

- PC-100 Synchronous DRAM (SDRAM)



Notes

RAM Expansion

The Power Macintosh G3 logic board provides four PC-100 DIMM slots, supporting a maximum of 256 MB per DIMM, for a total of 1 GB.

Compatible DRAM DIMMs must meet all the following specifications:

- PC-100 Synchronous DRAM (SDRAM)
- 3.3 volt
- 64-bit wide, 168-pin module
- No more than 16 memory devices on the DIMM
- A correctly programmed Serial Presence Detect ROM (256 bytes)
- Unbuffered; do not use registered or buffered Synchronous DRAM (SDRAM)
- Sizes of 32 MB, 64 MB, 128 MB in 64 Mbit technology may be used
- Sizes of 128 MB and 256 MB in 128 Mbit technology may be used
- Maximum height of 2.0 inches

DIMMs from older Macintosh computers may physically fit into the slots but they are not compatible and should not be used.

Logic Board

- Reset Logic Board procedure
 - Try reset of CUDA chip first
 - Remove battery for 10 minutes
- POST
 - At cold boot only:
 - 1 Beep: No RAM installed
 - 2 Beeps: Incompatible RAM installed
 - 3 Beeps: No RAM banks passed memory test
 - 4/5 Beeps: Bad checksum of boot ROM block

30

Notes

Resetting the Logic Board

Many system problems can be resolved by resetting the Cuda chip. Press the Cuda reset button on the logic board to reset the Cuda chip. If you continue to experience system problems, reset the Logic Board.

Resetting the logic board can resolve many system problems (see the Symptom/Cure tables for examples). Whenever you have a unit that fails to power up, you should follow this procedure before replacing any modules.

- 1 Unplug the computer.
- 2 Press the Power On button on the front of the unit.
- 3 Open the side access panel.
- 4 Remove the battery from the logic board.
- 5 Wait at least 10 minutes before replacing the battery.
- 6 Make sure the battery is installed in the correct +/- direction.
- 7 Reassemble the computer and test the unit.

Note: This procedure resets the computer's PRAM. Be sure to check the computer's time/date and other system parameter set-tings afterwards.

Power-On Self Test

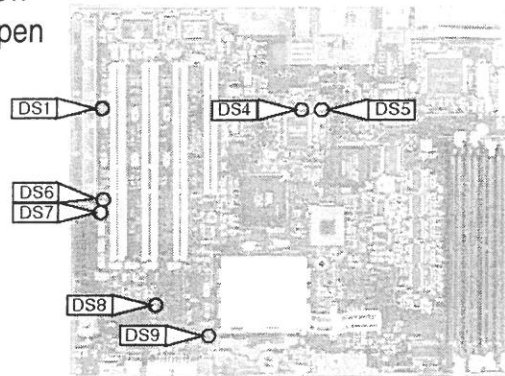
There is a power-on self test that resides in the ROM of the Power Macintosh G3. This test automatically runs whenever the Power Macintosh G3 is powered on after being shut down completely (the power-on self test does not run if the machine is only restarted). If a problem is detected during the test, you will not hear a normal startup chime. Instead, the system will beep as explained below.

- 1 Beep: No RAM installed or detected.
- 2 Beeps: Incompatible RAM types installed (for example, both SDRAM and EDO installed)
- 3 Beeps: No RAM banks passed memory testing.
- 4 or 5 Beeps: Bad checksum for the remainder of the boot ROM block. The ROM is bad and can probably not be fixed.

Logic Board LEDs

Logic Board LEDs Locator

- Power Remains On When Case is Open



31

Notes

DS1= ATA drive activity

If a CD and/or Zip are attached to the ATA bus, this LED will light up for a few seconds during power on/restart. If a hard disk drive is attached to this bus, the LED will flicker regularly, indicating drive activity (reads/writes).

Note: There is no DS2 or DS3 on the board.

DS4 and DS5= USB power for downstream devices

DS5 = USB port 1 - lower DS4 = USB port 2 - upper

When on, these LEDs indicate that the computer is providing power (+5V) to downstream USB ports. USB devices do not need to be connected in order for these LED's to be on. However, if one or both of the LEDs is not on and a USB device is/was attached (and the system has completed its boot process), then the logic board has removed downstream power because there is a problem. Since the downstream power is controlled individually for each port, it is possible to have these LEDs in different states: one off and one on. This way, if one port has malfunctioning USB devices then the other port can still be functional. These LEDs are not immediately turned on at the beginning of a restart or cold power on. During a successful/normal boot, the sequence will be as follows:

1. Unit is powered on and other LEDs will turn on while DS4 and DS5 remain off.
2. Then DS4 and DS5 will be on for a second or two.
3. Then off very briefly (1 sec).
4. Then back on (confirms secondary PCI bus is initialized and power is now available).

These two LEDs are often useful when troubleshooting an unpredictable system. If they stay on (stage 4), the secondary PCI bus has been initialized, something which happens relatively late in the boot/hardware initializing process.

DS6 = Ultra ATA bus activity

DS6 indicates Ultra ATA bus activity.

DS7 & DS8 = Power Indication

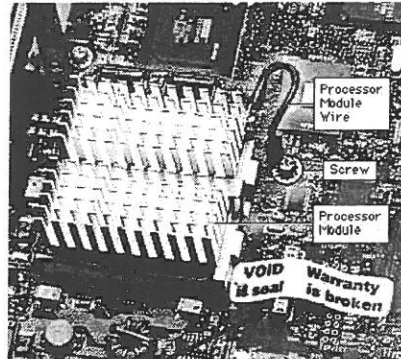
In a working unit, these LEDs should be in sync with each other: both on or both off. If one LED is on and the other is off, there is a problem.

DS9=CPU Bus Request

When on, this LED indicates that the CPU is requesting the bus. This LED will rarely glow as brightly as the others (e.g. the Ultra ATA LED), because the CPU is not always requesting the bus, and when it does, it will do so only for a short time. As a result, you may need to watch this LED more carefully than the others to tell if there is activity. If this LED is ever on continuously and bright, then there is a problem and the system has probably crashed.

Processor Module

- Jumper J25



Speed	Color	Part number
300 MHz	black	076-0759
350 MHz	blue	076-0760
400 MHz	white	076-0758

32

Notes

Processor Module

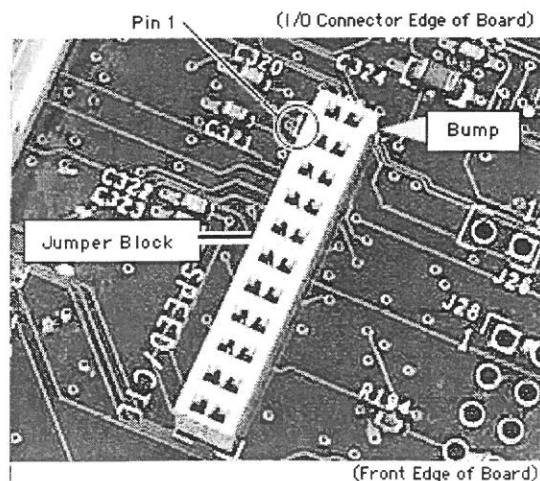
The logic board comes with a removable processor module. You can replace this module when the logic board or processor module fails. The processor module sits in a ZIF socket for easy removal. Processor modules can be ordered from Service, and each is shipped with the appropriate jumper configuration block to place in location J25. The processor should rarely fail. Replace it only as a last resort.

When replacing the processor module, you must change the processor jumper block and warranty sticker to be compatible with the processor module you are installing. Failure to install the jumper block properly will result in a unit that does not boot up. Refer to "Jumper 25 Orientation" on the following pages for installation instructions.

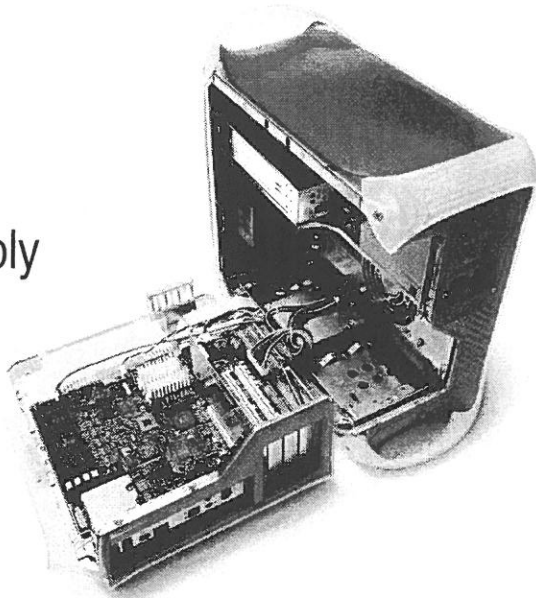
Jumper Location J25

The jumper block you place at location J25 configures the board to work with different processor modules. Use the appropriate jumper block, identified by color, for each processor module. Refer to "Processor Module" in Disassembly for instructions.

Jumper J25 Orientation



Disassembly



33

Notes

See Service Source CD or Service Source Online for details.

References on the Internet

- http://www.lai.nl/html/lkc_references.html
- <http://developer.apple.com/hardware/FireWire/>
- http://ssol.euro.apple.com/CD1/Service_Engineering/E_Service_Manuals/Service_Manuals/powermac_g3_blue.white.pdf
- <http://www.info.apple.com/support/index.taf?product=desktop>

34

Notes

Service Source Online Europe

In order to access the European service source online you need a password for Channelnet. This password is different for each service provider.

The US service source online still can be used as well, current password is

user: february

password: back%again

However, you should use the European source instead.

http://www.lai.nl/html/lkc_references.html

Our page with links used in this presentation.

<http://developer.apple.com/hardware/FireWire/>

Apple's page with FireWire information for developers.

http://ssol.euro.apple.com/CD1/Service_Engineering/E_Service_Manuals/Service_Manuals/powermac_g3_blue.white.pdf

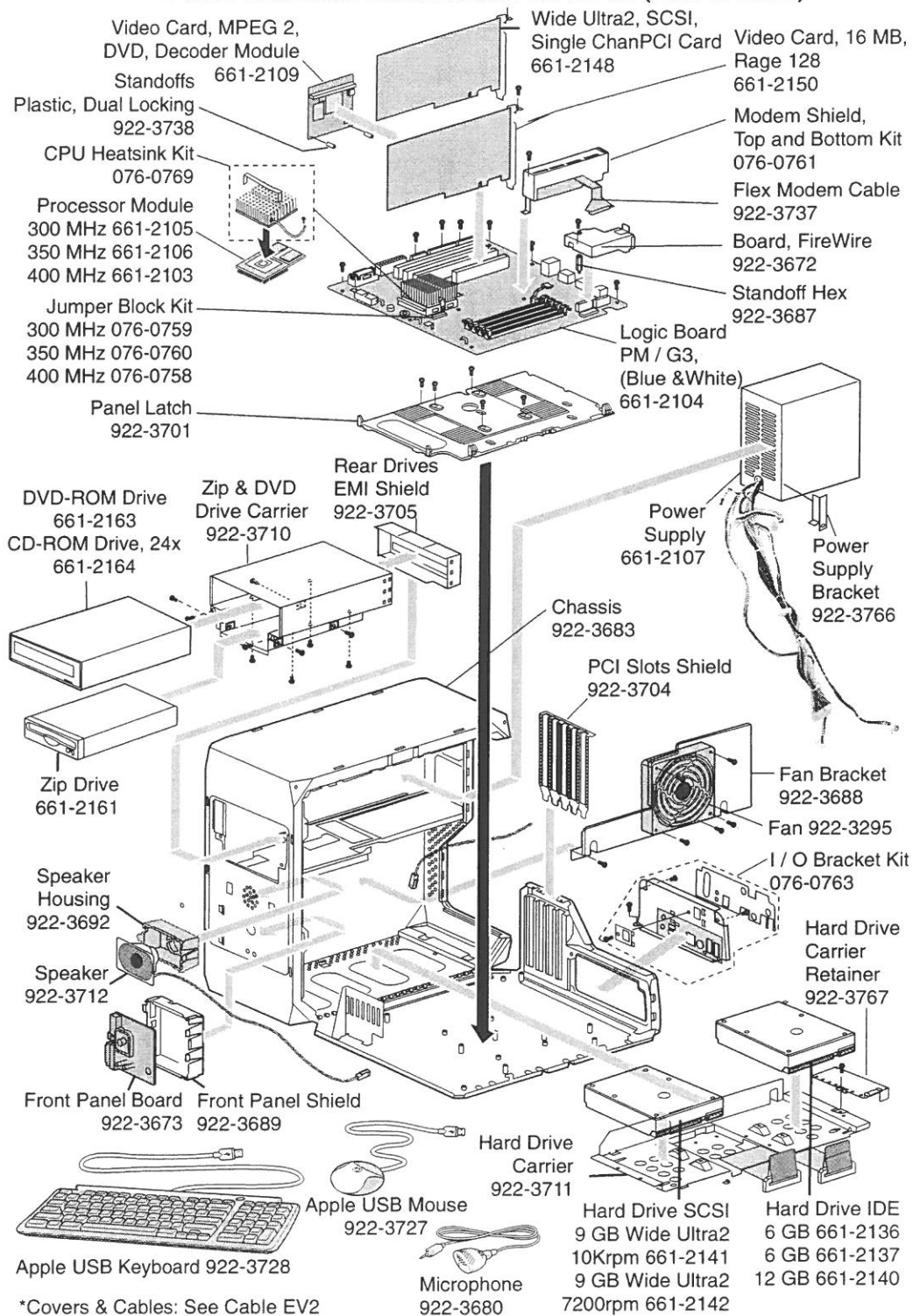
Service Source Online (Europe) G3 documentation.

<http://www.info.apple.com/support/index.taf?product=desktop>

Apple's Support page with G3 technical information.

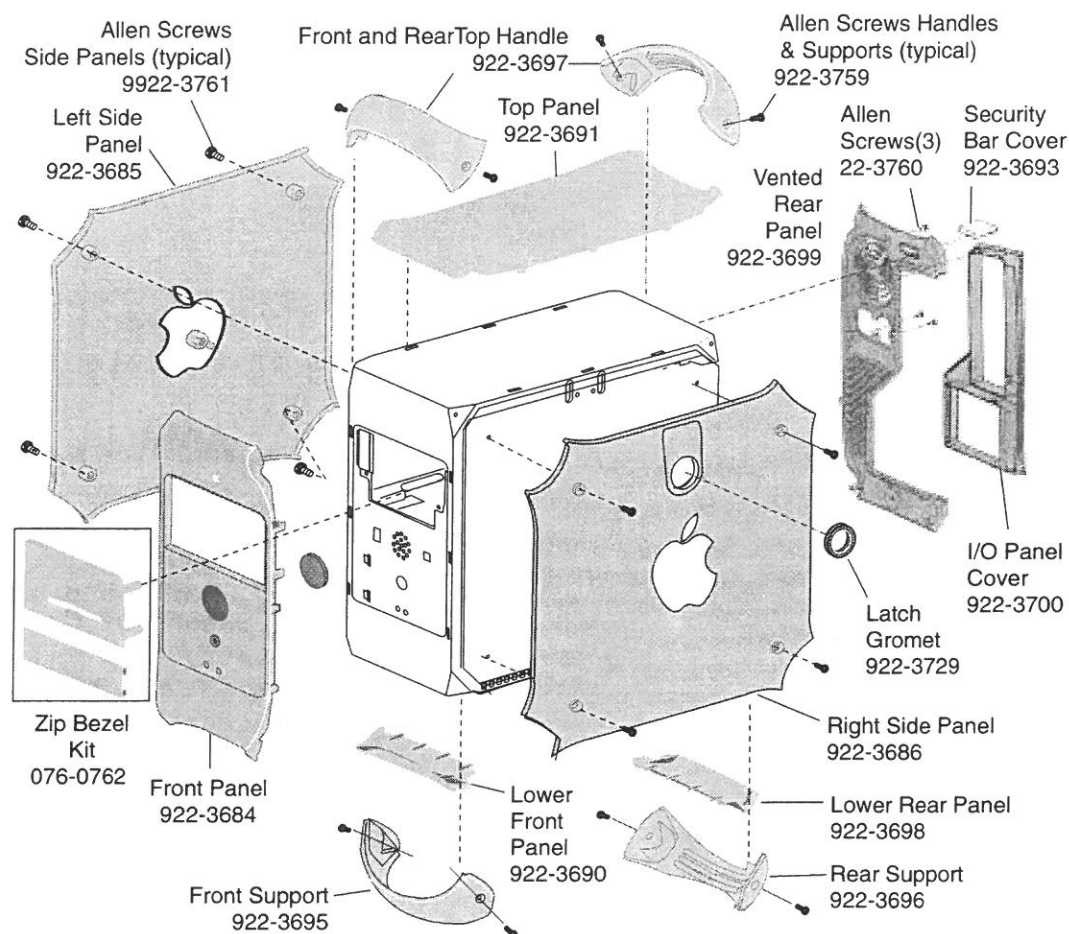


Exploded View #1

Power Macintosh G3/Macintosh Server G3 (Blue & White)



Exploded View #2

**Cables**