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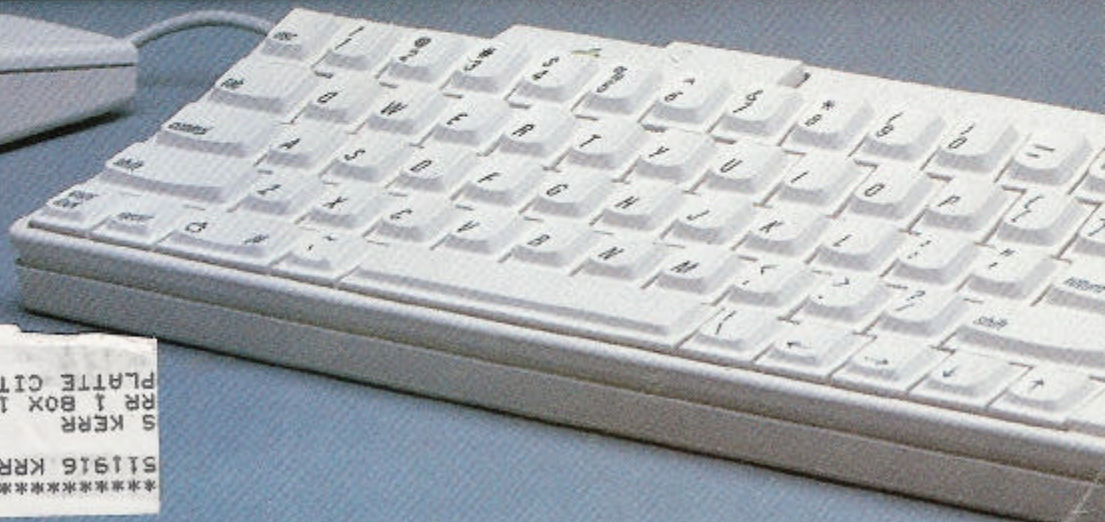
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NOVEMBER 1986 VOLUME 4/ISSUE 11

Apple IIgs
SPECIAL REPORT

A+

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THE APPLE IIgs!

the Apple IIgs's sound capabilities include music education, sound analysis, voice mail, digitized voices, and talking foreign-language dictionaries.

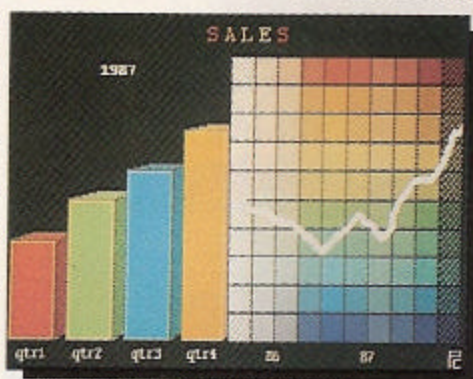
We are always striving to make sure *A+* readers are the best-informed group of Apple users. In keeping with that goal, we have put together this special report on the Apple IIgs. Our coverage begins with this article, which gives you an overview of the IIgs-related products that are being developed by Apple and an impressive number of third-party developers. Next, starting on page 45, we

have an article entitled "A Technical Overview of the Apple IIgs," which presents the main technical features of the new machine. Then, on page 57, comes

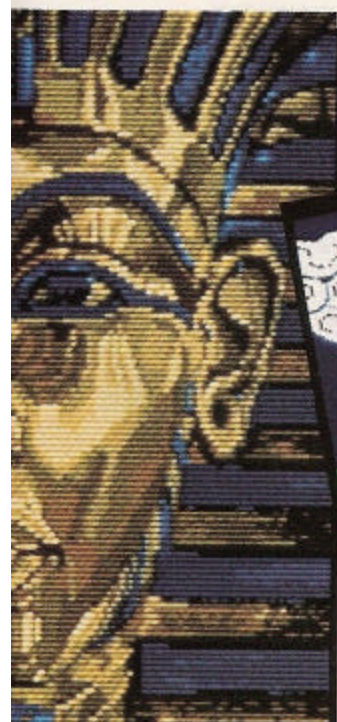
"The Making of the Apple IIgs" that gives you the story behind the machine. The last of our feature articles on the IIgs is "What's in the IIgs Toolbox?" which begins on page 77 and covers the

Macintosh-like Toolbox ROM, which gives the Apple IIgs a hefty dose of the Mac's personality.

But that's not all; three of our top columnists present their views about the



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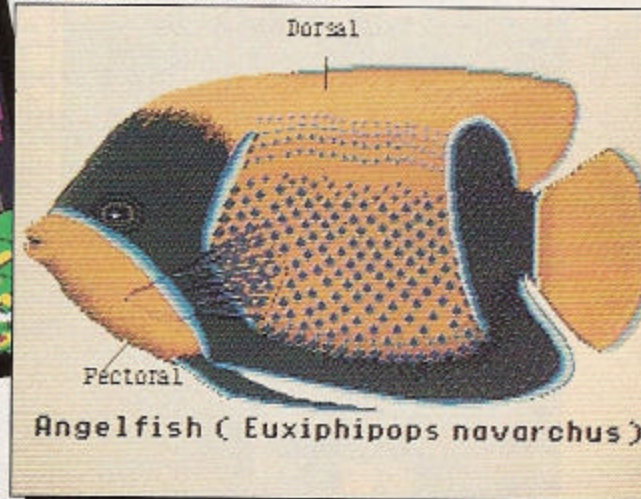


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EXPLORE-A-STORY FROM LEARNINGWAYS

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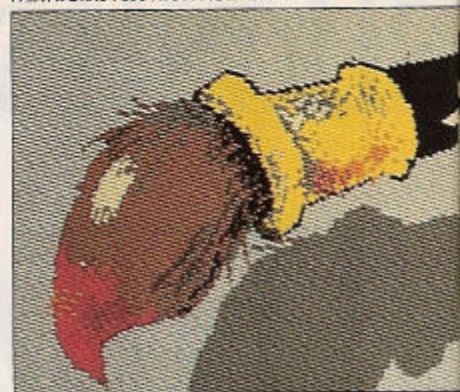


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IIGs in this issue. Don't miss David Thornburg's "Learning Curve," Steve Rosenthal's "Thoughtware," and Bob Lindstrom's new "GamePort" column.

MORE APPLE ANNOUNCEMENTS

In conjunction with the announcement of the Apple IIGs, Apple also introduced the Apple 3.5 Drive, the Hard Disk 20SC, a SCSI card for the Apple IIe and IIGs, a monochrome monitor and an RGB color monitor for the IIGs, and a new version of the best-selling AppleWorks program



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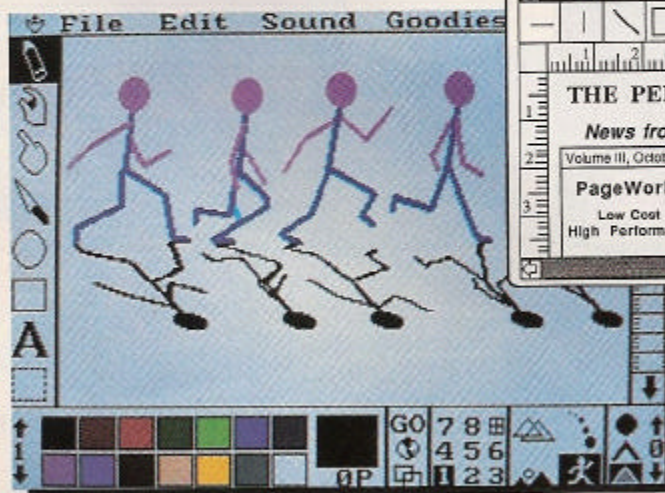
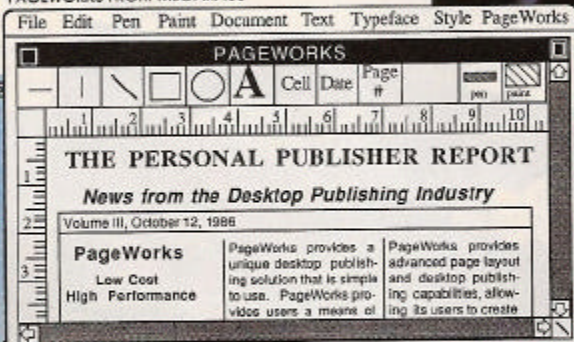
(version 2.0) that includes a built-in mail-merge function. The Apple 3.5 Drive is a new standard 3.5-inch disk drive with 800K of storage capacity that works with either the Macintosh or the Apple II series. The Hard Disk 20SC is a SCSI version of the Macintosh Hard Disk 20 that you can connect to the Macintosh Plus' SCSI port or to an Apple IIe or IIGs, using the new Apple II SCSI board. For more details, refer to the technical specifications of the newly announced hardware products on pages 46-47 of this issue.



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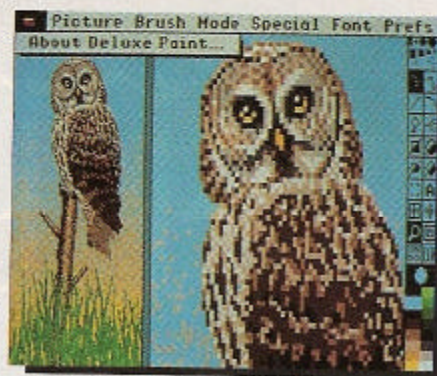
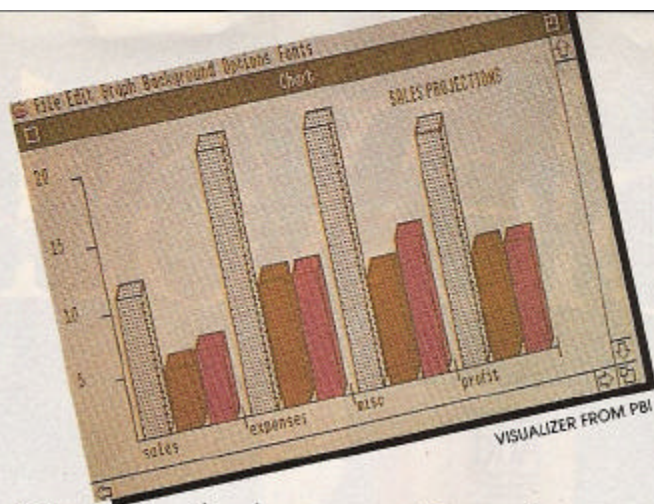
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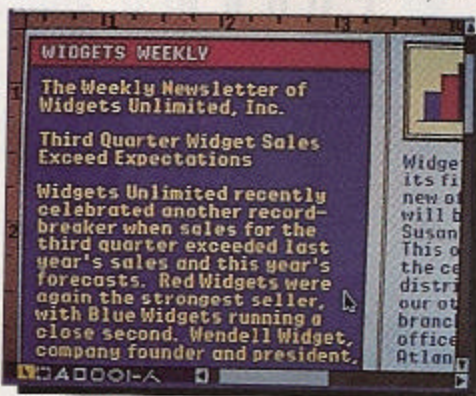
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In a surprise move, Apple has announced a new color for all Apple products. You can say good-bye to the beige of the Apple II, II Plus, IIe, III, Lisa, Macintosh, and their associated peripherals; you can say good-bye to the snow-white color of the Apple IIc, ImageWriter II, Personal Modem, and LaserWriter. The new Apple color is, believe it or not, gray. Although some people at Apple are calling this new color platinum, I'm sticking with calling it gray. Beginning with the Apple IIgs, the new light gray

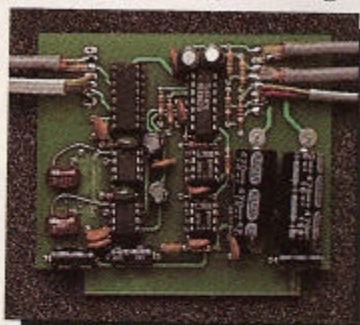
is to become the standard color of all Apple products. Apple has already changed the color of the Apple IIc to this color, and you can expect the company gradually to convert the Apple IIe, Macintosh, and all its other hardware products to the new gray.

DEVELOPERS FLOCK TO THE IIgs

Software and hardware developers have given the Apple IIgs a warm welcome, and it looks as if new products will be developed for the IIgs at a much faster rate than they were for the Macintosh. Although development efforts are still jell-



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THE APPLE IIe-TO-IIgs UPGRADE

One of the most exciting aspects of the Apple IIgs announcement is word that Apple IIe owners can upgrade their computers to an Apple IIgs. Just as Apple has offered Macintosh users upgrades from the 128K Mac to the 512K Mac and now to the Mac Plus, Apple has now established an upgrade path for the Apple II community, even though the upgrade is currently limited to owners of Apple IIe computers.

By upgrading your IIe to a IIgs, you will retain compatibility with most of your hardware and about 90% of your Apple II software while gaining the ability to run 100% of the new Macintosh-like software being developed for the IIgs. The upgrade involves simply swapping the IIe motherboard for a IIgs board and changing the back panel of

the Apple IIe to accommodate the IIgs's built-in connectors (see figures 1 and 2 below).

Upgrading from an 8-bit IIe to a 16-bit IIgs will give you the new 65816 processor, better graphics and sound, two serial ports, the AppleTalk network, a built-in disk-drive controller, and the Apple DeskTop Bus mouse connector. You will still have the same seven slots, but certain slots

are inactive when some of the built-in ports are in use. For example, a card in slot #1 will become inactive if the built-in serial port is used. On the other hand, a program looking for a serial card in slot #1 can use the built-in serial port if no serial card is in the slot.

Apple had not yet decided on the exact price or availability of the upgrade at the time of this writing, but it expects it to cost about \$600. Contact your local Apple dealer for more details about the Apple IIe-to-IIgs upgrade policy.

Personally, I think that Apple's upgrade program should have been expanded to include Apple II, II Plus, IIc, and IIx owners, but the company does not plan to offer owners of these other 8-bit Apples an upgrade at this time. —FD

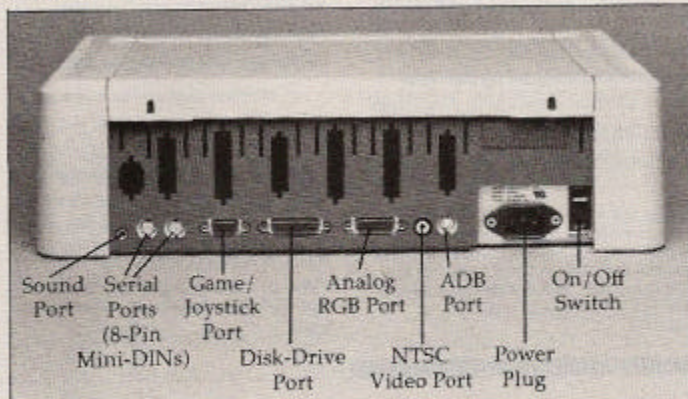


Figure 1: Upgraded Apple IIe back panel

1. 7 Expansion Slots

Compatible with the IIe

2. IWM

Integrated Woz machine
Single-chip disk controller

3. SlotMaker

Manages the expansion slots by generating control signals and buffers several clock signals

4. SCC

Serial Communications
Control chip
Provides AppleTalk

5. VGC

Video Graphics Controller
Provides all Apple IIe and IIc graphic modes and the new super-high-resolution modes

6. FPI

Fast Processor Interface
Controls system speed and "shadowing" and allows I/O access

7. Fast 128K RAM

8. Mega II

Integrates various chips of the Apple IIe and IIc

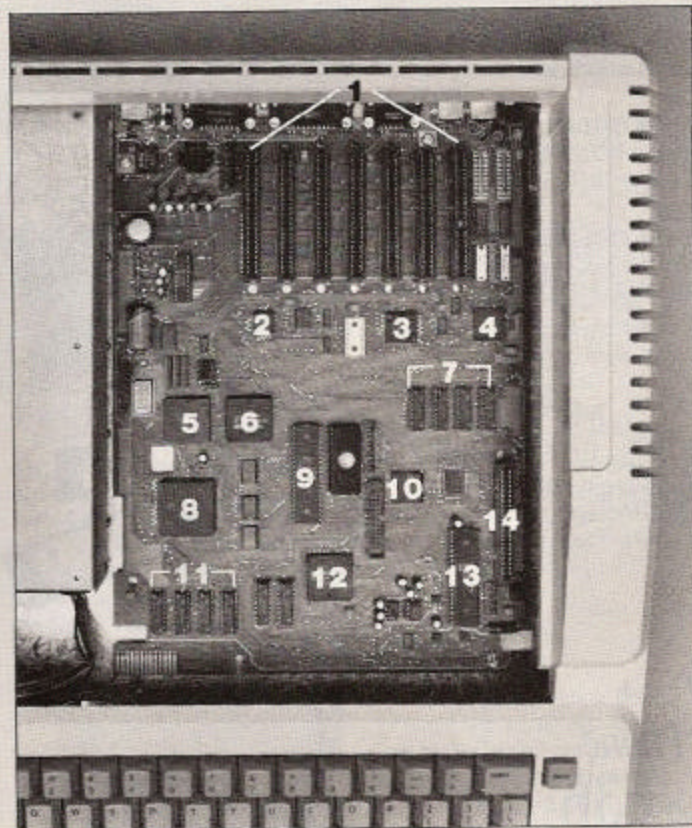


Figure 2: Upgraded Apple IIe with IIgs motherboard

9. 65C816 Processor

24 addressing modes: 13 original (65C02) plus 11 new modes with 91 instructions, using 255 opcodes
24-bit address bus for access to 16 megabytes of memory

10. Keyboard GLU

Interfaces Apple DeskTop Bus to the system

11. Slow 128K RAM

12. Sound GLU

Interfaces the Ensoniq chip, with its dedicated 64K RAM, to the Mega II, allowing the Ensoniq to run independently of the Mega II

13. Ensoniq Sound Chip

32-oscillator synthesizer that, in most uses, will play 15 voices simultaneously

14. Memory-Expansion Slot

Dedicated ROM/RAM expansion slot
ROM—up to 1 megabyte
RAM—up to 8 megabytes

serWriter or other PostScript printer.

Tom Snyder Productions is developing a IIGS version of its delightful Puppy Love program (see "News-Plus," September 1986, page 15), which combines fun and games with artificial-intelligence instruction. The company expects the program to be available through Addison-Wesley by Christmas.

TML Systems has created a IIGS version of its Macintosh Pascal language that allows programmers to write Pascal programs that run on both the Macintosh and the IIGS.

United Software has taken a lot of the features of its classic ASCII Express Pro telecommunications program and combined it with a Macintosh-like user interface to create ASCII Express MouseTalk, which promises to be one of the most powerful mouse-driven communications programs for any computer.

VIP Technology is developing a IIGS version of its VIP Professional spreadsheet that combines the Apple user interface with a Lotus 1-2-3

*This is just
the tip of the iceberg.
We'll be sure to keep
you up to date on
new IIGS happenings in
upcoming issues of A+.*

clone. In fact, VIP claims that the program is compatible with Lotus 1-2-3, Version 1A and can use the same files and commands as 1-2-3.

On the desktop-publishing front there is quite a bit of activity. Besides Brøderbund, which has the aforementioned NewsMaker, MegaHaus and Quark are producing their own programs. MegaHaus has introduced PageWorks, and Quark is developing Quark Extra. All of these packages work with the LaserWriter and other PostScript printers.

In the area of financial management and accounting, Chang Labs

has converted its popular Rags to Riches accounting program from the Macintosh to the IIGS. Monogram has converted the Macintosh version of the best-selling Dollars and Sense to the IIGS. MECA has written a IIGS version of its Managing Your Money program, and VIP Technologies is producing a IIGS version of its VIP Professional spreadsheet.

In the education arena, Learningways is working on a version of its Explore-A-Story program that makes use of some IIGS features, and Scholastic is tweaking Talking Text Writer to take advantage of some of the IIGS's capabilities.

Tip of the Iceberg

All in all, a very respectable amount of new products is in development for the IIGS; indeed, the above list is just the tip of the iceberg. We'll be sure to keep you up to date on new IIGS happenings in upcoming issues of A+.

Following this article is the continuation of our special report on the IIGS. Read on and enjoy. +

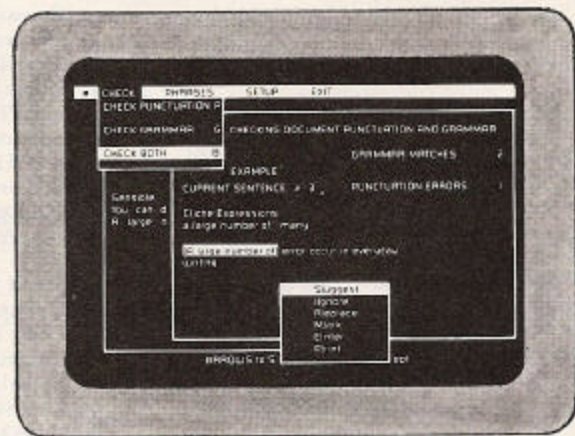
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...dressing modes are available that let you develop faster and more compact programs.

System Speed

The 65816 of the GS operates at an effective clock rate of either 1 MHz or 2.5 MHz, selectable through a software switch. In the fast mode (2.5 MHz), the GS operates much like a IIe with an Applied Engineering Trans-Warp card (or similar speedup card)—about 3½ times as fast as usual. (Actually, a IIe with an accelerator card operates faster than the GS.) In the slow mode, the GS operates at the same speed as a standard IIe or IIc.

Memory Space

The 65816 treats memory as a consecutive series of 256 banks, each 64K in size, rather than as one continuous 16-megabyte space (see figure 2). A GS, in its minimal configuration, uses only six of these banks, four for RAM (256K) and two for ROM (128K).

The core RAM banks are numbers \$00, \$01, \$E0, and \$E1. You can add more RAM by installing a memory card in a special memory-expansion slot on the motherboard; this RAM occupies consecutive banks starting with bank \$02. Apple's memory card can hold up to four megabytes, although you'll probably use only 256K or one megabyte until memory prices drop. The GS ROM occupies banks \$FE and \$FF and contains Applesoft (yes, the same old Applesoft), an enhanced system monitor, firmware for built-in I/O ports, and some programming tools.

All IIe-style applications load and run in banks \$00 and \$01 on the GS. They work properly because the GS hardware configures these two banks to behave like main and auxiliary memory on the IIe, complete with language-card (bank-switched-RAM) spaces. The main difference is that the simulated main and auxiliary memory areas contain no special video memory buffers for the text and graphics display modes. (You store data in a video buffer when you want to change what's displayed on the screen.) These buffers are in RAM banks \$E0 and \$E1 instead.

A IIe application still works properly on the GS, however, because every time it writes to what it thinks is a video buffer in bank \$00 or \$01, the GS causes a write to the actual buffer

Technical Specifications

Apple IIGS

PROCESSOR

65816 microprocessor, 2.8 MHz clock speed, 8-bit data bus; 24-bit address bus allows for addressable memory of 16 megabytes

MEMORY

256K RAM standard, expandable to 8 megabytes
128K ROM standard, expandable to 1 megabyte

OPERATING SYSTEMS

Works with ProDOS 16, ProDOS 8, Pascal, CP/M (with Z80 card), and DOS 3.3

EXPANSION SLOTS

8: 1 dedicated multipurpose RAM/ROM memory-expansion slot; 7 additional input/output slots

GRAPHICS DISPLAY

7 video-display modes:

- 40-column text mode (by 24 lines)
- 80-column text mode (by 24 lines)

Low resolution: 40 H by 4 V dots, 16 colors

High resolution: 260 H by 192 V dots, 6 colors

Double high resolution: 560 H by 192 V dots, 16 colors

Super high resolution: 320 H by 200 V dots, 16 colors

per scan line out of a palette of 4096 colors; 640 H by

200 V dots, 4 colors per scan line out of a palette of

4096 colors

SOUND CAPABILITY

Ensoniq 32-oscillator synthesizer chip with dedicated 64K RAM

Apple 3.5 Drive

RECORDING MEDIA

Disk Diameter: 3.5 inches
Recording Surfaces: 2
Tracks Per Surface: 80

CAPACITY

Formatted: 800K

INTERFACE

Connects directly to Apple IIes or Macintosh disk-drive port

DRIVE CHARACTERISTICS

Seek Time: 6 milliseconds max.
Settle Time: 30 milliseconds max.
Drive Start-up Time: 600 milliseconds max.

Apple 5.25 Drive

RECORDING MEDIA

Disk Diameter: 5¼ inches
Recording Surfaces: 1
Tracks Per Surface: 35

CAPACITY

Formatted: 140K

INTERFACE

Connects directly to Apple IIgs and IIc; IIe, II Plus, and II require Apple 5.25 Drive Controller

DRIVE CHARACTERISTICS

Seek/Settle Time: 50 milliseconds max.
Drive Start-up Time: 1.0 milliseconds max.



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munications programs will probably announce updates shortly.

The disk-drive port, called the Smart Port, can handle up to four external drives connected in a daisy-chain arrangement. The standard GS package has one 800K UniDisk 3.5 drive connected to this port.

The connectors for the two serial ports and Smart Port are at the back of the GS system unit. There you will also find connectors for a game controller, the keyboard, and composite (NTSC) and RGB video. The connector for the mouse is on the side of the keyboard.

The seven internal expansion slots are almost identical to their IIe counterparts, meaning that most single-function cards available for the IIe also work on the GS. Multifunction cards that create phantom slots (such as the AST Multi-I/O and the Street Electronics BusinessCard) do not work, however, since the 65816's 24-bit addresses confuse them. Of course, you won't need to use cards such as these anyway, since the GS already includes ports for the most popular I/O functions.

The Keyboard

The GS keyboard has all the features of the IIe keyboard, and more. Two improvements are noticeable immediately: The keyboard connects with a flexible cord to the system unit and includes a numeric keypad. The keyboard has several other features:

- Different keyboard layouts are available, including QWERTY (of course), Dvorak, and others such as French, German, USA, English, and more. The character-generator ROM contains eight different character sets to go along with the keyboard layouts.
- The auto-repeat speed is user-selectable.
- The keyboard has a type-ahead buffer.
- You can read the up/down state of each of the modifier keys (Caps Lock, Shift, and Control) directly.

You can use the Control Panel to change many of the operational characteristics of the keyboard. Since these characteristics are stored in a battery-backed-up memory area, the GS remembers them every time you restart the system.

Figure 1: The 65816 register sets in the emulation and native mode

	65C02 emulation mode	65816 native mode
Accumulator	7 0 A	15 7 0 A or C B A
X Index Register	x	x XH XL
Y Index Register	y	y YH YL
Data Bank Register		23 16 B B = Data Bank Register
Stack Pointer	01 S	00 S SH SL
Direct Register		00 D DH DL
Program Counter	15 0 PC PCH PCL	K PC K PCH PCL K = Program Bank Register
Status Register	P	P

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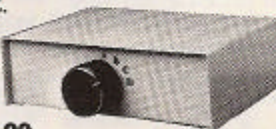
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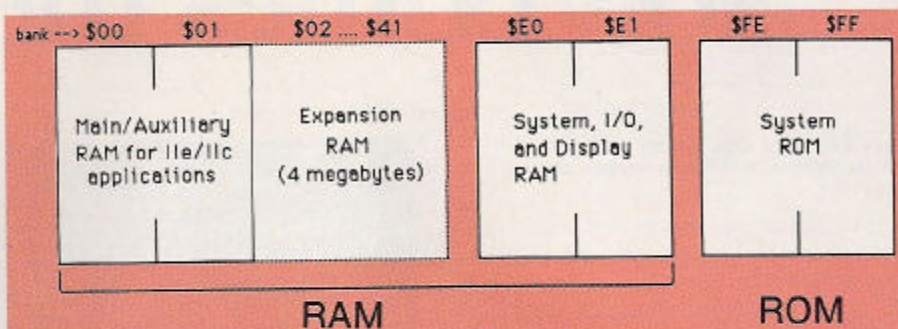


Figure 2: The Apple IIGS memory map—each RAM bank is 64K in size.

Apple Desktop Bus

The keyboard connects to the GS through a new intelligent I/O port called the Apple Desktop Bus (ADB). The ADB lets you daisy-chain the keyboard and a variety of pointing devices, such as the GS mouse. The daisy-chain connector is on the side of the keyboard. Apple has published the software and hardware protocol for the ADB, so I suspect we'll soon be seeing devices such as graphics tablets, trackballs, and light pens for connection to the ADB.

Sound

The sound emanating from the GS has much more potential than that of any other microcomputer currently on the market. The GS's sound chip is called the Ensoniq DOC (Digital Oscillator Chip) and is the same chip the Mirage music synthesizer uses.

The Ensoniq has 32 waveform oscillators, two of which are reserved for internal timing. The remaining 30 oscillators are paired off to form 15 independent sound generators or voices. Every voice can "sing" any waveform you like, at a specified volume and tempo, so you can generate complex sound effects or music.

Clock

A real-time clock is built into the GS. It is battery-operated, so it keeps time even when the GS is turned off. A nice feature of the clock is that it does not use up an I/O slot or port, as it usually does when you add a clock card to the IIGS. A new version of ProDOS for IIGS-style applications (the successor to version 1.1.1) installs a driver for the clock as soon as it senses it is running on a GS.

Super-High-Resolution Graphics

The GS provides all the video-display modes of the IIGS and IIGS, in addition to two new color-display modes, called super-high-resolution graph-

ics, with these pixel dimensions: 320 (horizontal) by 200 (vertical) and 640 (horizontal) by 200 (vertical). The video buffer for both these modes is 32K in size and is located from \$2000 to \$9FFF in bank \$E1.

Each horizontal line on the super-high-res screen can be associated with any one of 16 user-definable color palettes, each of which contains the definitions of 16 colors that can appear on the line. Thus, up to 256 different colors can appear on the screen at one time, but with clever programming, using scan-line interrupts, you can display many more. Every color within a palette is defined by a 12-bit code (4 bits for red, 4 bits for green, 4 bits for blue), meaning it can be one of 4096 different colors. That should provide enough variety to keep game designers and artists happy for quite a while!

In the 320 x 200 mode, you can assign any of the 16 colors in a palette to a pixel on the line. Each pixel is defined by four data bits containing the color number within the palette. The 640 x 200 mode is more restrictive, however—only 4 of the 16 colors in the palette can be assigned to a pixel (two bits per pixel). Which 4 of the 16 are available depends on the horizontal position of the pixel.

ProDOS Operating System

There are two versions of ProDOS you can use with the GS; the one you use depends on the type of application you're running. Standard ProDOS, the one that works on the entire Apple II line, is now called ProDOS 8 and must be used with IIGS-style applications. ProDOS 16 works with applications that run in the 65816 native mode, so it runs on the GS only. The fundamental difference between ProDOS 16 and ProDOS 8 is that a program can execute ProDOS



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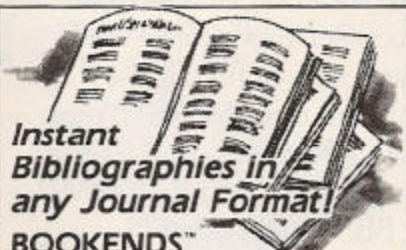
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16 commands from anywhere in the 16-megabyte memory space and can perform I/O transfers anywhere in memory. ProDOS 8, on the other hand, works only in the lowest 64K of memory.

Software Tools

Apple has made it clear it would like GS-specific applications to use the desktop metaphor the Macintosh has popularized. To this end, it has created a Macintosh-like toolbox of standard subroutines that programmers can use to easily create windows, pull-down menus, dialog boxes, and other user-interface trappings on the super-hi-res screen. The core group of drawing routines is called—what else?—QuickDraw II. See the book excerpt "What's in the Toolbox?" in this issue for more information on this aspect of the IIGS.

Many of the GS tool sets are located in ROM; application programs load others from disk as they need them. Eventually, as the tool sets stabilize, the RAM-based tool sets will find their way to ROM, as they have on the Mac, meaning that more RAM space will be available for applications, which will run more quickly.

Apple is currently putting the finishing touches on a Programmer's Workshop for developers of GS software. It will include an editor for creating source-code files, a 65816 assembler, and a linker for creating executable applications from object-code modules created by the assembler or a compiler.

Apple intends to release two high-level-language compilers—C and Pascal—for the GS Programmer's Workshop. When I wrote this article (in early August), however, both were still in development, and all I had seen was some preliminary documentation for C. Strangely enough, Apple does not appear to be working on a compiled BASIC for the GS—perhaps we'll see one from an independent publisher instead. You can still use Applesoft, of course, but it won't take advantage of any of the new features of the GS, including the extra memory space.

The Future of the GS

The GS will be attractive to those who love flashy graphics and symphonic sound, at least once some good software that exploits these fea-

tures becomes available. It still makes sense to buy the GS in the meantime, however, because it runs existing software about 2½ times faster than the IIe does, it has a better keyboard, and it has built-in I/O ports and expansion slots.

I do not expect to see developers of business and productivity software stampeding to use QuickDraw II and the user-interface tools to create Macintosh-like applications on the GS. The reason is simple: Text-screen operations are much faster than graphics operations, and users want speed. The speed differential is particularly great for applications, such as word-processing programs and communications programs, that frequently update and scroll the screen.

Ease of use is not really an issue, since programs based on the text-based file-card metaphor, such as AppleWorks, have proven to be just as easy to learn as those based on the Macintosh desktop metaphor. Obviously, some business applications will use the super-hi-res graphics screen; they include charting and drawing programs, database programs that work with images rather than text, and word-processing programs that display text as it will appear when printed. Just don't expect them to run as quickly as the equivalent programs on the Macintosh do.

I expect to see, very soon, new versions of the classic text-screen-based business applications we already have on the IIe and IIc, rewritten to take advantage of the extra memory the GS offers. They will probably work with the mouse as well, because it is standard equipment on the GS. ✚

Gary Little practices computer law in Vancouver, British Columbia, and enjoys writing about Apple computers in his spare time. His next book, Exploring the Apple IIGS, will be published by Addison-Wesley in early 1987.

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