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Power Macintosh Computers: Using FPM, EDO, SDRAM, & SGRAM

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TOPIC -----

I am confused about the different types of memory that are being used in current Apple products. What is meant by FPM, EDO, SDRAM, and SGRAM? Which Power Macintosh computers support these different memory types?

DISCUSSION -----

Fast-Page Mode (FPM), Extended-Data Out (EDO), Synchronous Dynamic Random Access Memory (SDRAM), and Synchronous Graphic Random Access Memory (SGRAM) are different types of memory used in various Power Macintosh computers. The table below summarizes the types of memory supported by different Power Macintosh computers. Detailed information follows the table.

Begin_Table

Power Macintosh Models	FPM	EDO	SDRAM	SGRAM
6100, 7100, 8100	YES	YES, but acts as FPM	NO	NO
4400	NO	YES VRAM: 5 V DRAM: 3.3 V	YES, but as video memory ONLY	YES, but as video memory ONLY
5200, 5300, 6200, 6300	YES	YES, but acts as FPM	NO	NO
5400, 6360, some 6400	YES	YES, but acts as FPM	NO	NO
5500 & 6500	NO	YES	NO	YES, but as video memory ONLY. Has 2 MB installed and is NOT expandable
6400 (some)	YES	YES	NO	NO

configurations ONLY)*				
7200	YES	NO (may damage logic board)	NO	NO
7300, 7500, 7600, 8500, 8600, 9500, 9600	YES	YES, but acts as FPM DRAM: +5V	NO	NO

End_Table

*NOTE: The Macintosh Performa 6400/200 computer that includes an internal Zip drive supports EDO memory.

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| Fast-Paged Mode Memory |
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A specific location in a memory chip is identified by the row and the column addresses. Each time memory is accessed, the memory controller first supplies the chip with the row address and then the column address. After the information obtained from these locations is validated, the column deactivates and gets ready for the next cycle. This introduces a wait state because nothing is happening while the column is deactivating. The processor must wait for the memory to complete the cycle.

The Fast-Paged Memory (FPM) chip decreased the time required to read these addresses by allowing the memory controller to select a particular row and then access the corresponding column addresses for that row. This process works under the assumption that the next piece of data needed is in the memory location adjacent to the previous piece. Because the row address is only set up once and only the column address changes, this saves time when reading or writing information to or from memory.

Using FPM memory in Power Macintosh computers

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Most Power Macintosh computers support Fast-Paged Mode Memory. The only exceptions are the Power Macintosh 4400, 5500, and 6500 series computers.

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| EDO Memory |
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EDO (Extended Data Out) DRAM is a subset of FPM memory that saves the memory controller even more time by allowing it to begin locating the row and column for the next address, while reading the data at the first address. It is able to do this because EDO memory keeps the output buffer on while preparing for the next read operation. By keeping the buffer on, EDO eliminates wait states. This speeds up data transfer rates since EDO RAM can access data continuously without waiting for addresses to be located. This reduces the time of the read cycles by

approximately 10%. However, during write cycles, the system behaves exactly as an FPM chip would behave.

Although EDO devices improve timing efficiency to main memory by approximately 10%, it does not necessarily mean programs will execute 10% faster. The processor often gets instructions and data from cached memory, for example, L1 cache within the PowerPC microprocessor and or L2 cache on the logic board.

Using EDO memory in Power Macintosh computers

Because EDO DRAM is a subset of FPM memory EDO DRAM can typically be used in place of Fast Page Mode DRAM. However, unless the memory controller is designed to use the faster EDO timing, the memory performance will be the same as Fast Page Mode.

There are three categories of Power Macintosh computers based on their level of EDO memory support. In some Power Macintosh computers, you can use EDO memory and get some potential performance boosts. In others, you can use EDO memory even though you will not derive any benefits from doing so. Finally, there are some Power Macintosh computers in which Apple does not recommend using EDO memory because doing so may damage your computer.

Power Macintosh Computers that Support EDO Memory

The following Power Macintosh computers fully support EDO memory and may experience increased performance:

- Power Macintosh 4400 series
- Power Macintosh 5500 series
- Power Macintosh 6500 series
- Macintosh Performa 6400/200 with internal Zip drive

All memory installed must be EDO to take advantage of the benefits. If you mix FPM and EDO RAM, the EDO modules will perform as if they were FPM.

IMPORTANT: There are two types of EDO memory--5 Volt and 3.3 Volt. The Power Macintosh 4400 series requires 3.3 Volt EDO memory whereas the Power Macintosh 5500, 6500, and 6400 computers require 5 Volt EDO. The two types of EDO memory are NOT interchangeable. Most 5 V and 3.3 V EDO memory are physically keyed differently to prevent you from using the wrong type, but even if the DIMM can be installed, verify that you are installing the correct type.

Additionally, EDO memory can also be used as video memory in the Power Macintosh 4400 ONLY. However, when using EDO memory as video memory, the Power Macintosh 4400 uses 5 Volt EDO memory rather than the 3.3 Volt used as DRAM.

Power Macintosh Computers that Can Use EDO memory

Although you will not derive any performance benefits by using EDO DIMMs, you can use them in the following Power Macintosh computers:

- Power Macintosh 6100 series
- Power Macintosh 7100 series

- Power Macintosh 8100 series
- Power Macintosh 5200 series
- Power Macintosh 5300 series
- Power Macintosh 5400 series
- Power Macintosh 6200 series
- Power Macintosh 6300 series
- Power Macintosh 6400 series
- Power Macintosh 7500 series
- Power Macintosh 7600 series
- Power Macintosh 8500 series
- Power Macintosh 9500 series
- Macintosh Performa 6360 series
- Some Macintosh Performa 6400 series

Power Macintosh Computers that CANNOT use EDO memory

You cannot use EDO DIMMs in the Power Macintosh 7200 computer. Using EDO memory in the Power Macintosh 7200 computer can cause damage to the logic board and to the DIMMs. Because of this, Apple does not support using EDO memory in the Power Macintosh 7200 computer. Any damage incurred from using EDO memory in the Power Macintosh 7200 computer may not be covered under Apple Computer's limited hardware warranty.

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 | SDRAM |
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The processes performed by a computer are coordinated by an internal clock, but memory access has traditionally used its own fixed timers for reading and writing data. Rather than synchronizing its actions with those of the internal clock, memory access had set times for reading and writing data regardless of the actual time the processes required. This would sometimes result in periods of wait cycles where nothing was happening. Because of this, memory was considered to be "asynchronous".

However, Synchronous Dynamic Random Access Memory (SDRAM) eliminates this difference between memory speed and processor speed because SDRAM has a clock synchronized with the computer's central processing clock. Thus, SDRAM uses only the time required to read/write data which increases data transfer rates by eliminating non-productive periods of waiting. The clock coordinates with a computer's central processor's clock so that data can be delivered continuously to the microprocessor. The timing coordination between memory, the microprocessor, and other support chips permits more efficient memory access and eliminates wait states. This results in memory access speeds of up to 20% faster than EDO.

Using SDRAM memory in Power Macintosh computers

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Only the Power Macintosh 4400/200 series support the use of SDRAM. Additionally, SDRAM is supported in these computers ONLY for video memory. You cannot use SDRAM as the primary memory devices on the logic board. The Power Macintosh 4400

series includes 2 MB of EDO memory for video memory, but it supports up to 4 MB of SDRAM or SGRAM.

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+====+
| SGRAM |
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Synchronous Graphics Random Access Memory (SGRAM) functions similarly to SDRAM except that it has added graphics support. Graphics support is provided by adding block write and masked write (or write-per-bit) functionality.

Block write enables the graphics engine to do block transfers of graphical data, such as tiling, and to interpret these larger data packets. Block write is often used in 3-D operations to clear the buffers or to prepare them for new rendering. With the block write function in the graphics memory, the graphics engine is free to do other tasks which increases performance. Masked write simplifies changing selected bits in a block of data. Masked write increases graphics performance with tasks such as color management of the display.

Using SGRAM memory in Power Macintosh computers

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SGRAM is supported in the Power Macintosh 4400, 5500, and 6500 series. SGRAM is supported in these computers for video memory ONLY; you cannot use SGRAM as the primary memory devices on the logic board.

The Power Macintosh 4400 series includes 2 MB of EDO memory for video memory, but it supports up to 4 MB of SDRAM or SGRAM. However, the Power Macintosh 5500 and 6500 series computers include 2 MB of SGRAM, which is NOT expandable.

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- 27 Feb 1997 - Modified text.
- 24 Feb 1997 - Updated and added additional information.

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