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# Macintosh Quadra 950: Expansion Slots

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TOPIC ----------

The Macintosh Quadra 950 computer has five NuBus slots and one PDS (processor-direct slot) line with NuBus slot $E and uses the same opening in the back. The use of a PDS card precludes the use of a NuBus card in slot $E.

DISCUSSION ----------

NuBus slots
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NuBus in the Quadra 950 provides all the benefits found in the Quadra 900:

- Provides higher power

- Accommodates oversized NuBus cards

- Supports some of the NuBus '90 features

Higher Power
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The power supply in the Quadra 950 computer is designed to provide additional current on the +5V outputs for the NuBus slots, compared with the current specified in "Designing Cards and Drivers for the Macintosh Family," second edition. The Quadra 950 has enough power to support a total of two 25-watt cards and three 15-watt cards.

Oversized NuBus Cards
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Each NuBus slot can accommodate either a standard NuBus card or an oversized card. The oversized card is the same length as a standard NuBus

card, but it is 2 inches taller. Each NuBus slot in the Quadra 950 computer includes a card guide; to install an oversized card, the user removes the card guide.

## NuBus '90 Features

NuBus '90 is the 1990 proposal for revision of the IEEE standard for the NuBus (IEEE STD R1196-R-1990). Apple has a representative on the panel designing the new standards, and has had since its inception. The specifications for NuBus '90 are incomplete and still under development, but Apple has implemented the portion of the specifications that are completed. Apple will be updating the implementation as the specifications expand and stabilize. The NuBus slots in the Quadra 950 computer provide the following new features described in that proposal:

- Low current at +5 V is available on the new STDBYPWR pin when main power is off and the AC cord is plugged in.

- New signals /TM2, /CLK2X, and /CLK2XEN support block transfers at double the standard rate (20 MHz). The Quadra 950 computer allows double-rate block transfers between NuBus cards, but doesn't support double-rate transfers to or from the main memory (this remains at 10 MHz).

- NuBus '90 defines new signals SB0 and SB1 for a serial bus on the formerly reserved pins A2 and C2. The serial-bus signals are bused and terminated, but the main circuit board doesn't drive them.

- NuBus '90 defines new signals /CM0, /CM1, /CM2, and /CBUSY to support a cache coherency protocol. Pins on the NuBus connector are assigned to those signals, but the Quadra 950 system doesn't support them.

## Processor-Direct Slot

For maximum performance, the processor-direct slot (PDS) is connected directly to the MC68040 microprocessor by way of the system bus. Possible applications for a PDS expansion card include cache memory, a video frame buffer, a DMA-based I/O controller, expansion memory, or even an additional MC68040 microprocessor. When a PDS card is installed, slot $E is unavailable for a NuBus card.

A PDS card can have memory locations in the upper part of the RAM memory space or in the space assigned to NuBus slot $E. If the card uses slot $E addresses, it must decode all addresses in both the slot space and the super slot space, responding to any access to an unused location with a TEA on the processor bus to indicate an illegal address.

A typical PDS card maps into the NuBus space and works with the system software's Slot Manager. Such a card must contain a NuBus declaration ROM and must notify the NuBus controller that it is using the NuBus space by asserting (pulling low) the signal /PDS.SLOT.E.EN on the PDS connector.

WARNING: A PDS expansion card for the Quadra 950 computer must be designed to work with the MC68040 microprocessor; PDS cards designed for computers

that use the MC68020 or the MC68030 won't work in the Quadra 950 computer.

A PDS card for the Quadra 950 computer has the same dimensions as a NuBus card and can include a back-panel connector. When the PDS card is installed, it occupies NuBus slot $E, reducing the number of available NuBus slots from five to four. Any PDS card designed to operate in the Quadra 950 must be capable of meeting the 33 MHz timing specification for the Motorola 68040. This requires shorter output delay times than the 25 MHz timing. Otherwise, PDS connector pinouts, size and placement are identical among the Macintosh Quadra 900, 700, and 950.

IMPORTANT: The signals on the PDS connector are connected directly to the MC68040 with no buffers. Therefore the address, data, and clock lines on a PDS card must present capacitive loads of not more than 40 pF. The control lines must present capacitive loads of not more than 20 pF.



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