

# New Technical Notes

Macintosh



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Developer Support

## PDS Expansion Interface Q&As

Hardware

M.HW.PDS.Q&As

Revised by: Developer Support Center

October 1992

Written by: Developer Support Center

October 1990

This Technical Note contains a collection of Q&As relating to a specific topic—questions you’ve sent the Developer Support Center (DSC) along with answers from the DSC engineers. While DSC engineers have checked the Q&A content for accuracy, the Q&A Technical Notes don’t have the editing and organization of other Technical Notes. The Q&A function is to get new technical information and updates to you quickly, saving the polish for when the information migrates into reference manuals.

Q&As are now included with Technical Notes to make access to technical updates easier for you. If you have comments or suggestions about Q&A content or distribution, please let us know by sending an AppleLink to DEVFEEDBACK. Apple Partners may send technical questions about Q&A content to DEVSUPPORT for resolution.

|New Q&As and Q&As revised this month are marked with a bar in the side margin.

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### Macintosh Classic II expansion connector pinouts

Written: 12/11/91

Last reviewed: 8/1/92

Where can I find documentation on the Macintosh Classic II expansion connector pinouts?

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The schematics and specifications for the Classic II are documented in the “Macintosh Classic II, Macintosh PowerBook Family, and Macintosh Quadra Family Developers Notes.” You can order this document from APDA for approximately \$25. The order number is #R0143LL/A. You can contact APDA at:

Apple Computer, Inc.  
20525 Mariani Avenue, Mail Stop 33-G  
Cupertino, CA 95014  
(800) 282-2732  
AppleLink: APDA

A notable difference between the Classic and previous compact Macintosh models is the new FPU/ROM connector, which replaces the earlier Processor Direct Slot. Full details about this connector are available in the Developer Notes.

### **Processor Direct Slot (PDS) adaptor card documentation**

Written: 8/30/91  
Last reviewed: 8/1/92

Processor Direct Slot (PDS) adaptor card specifications for the Macintosh IIsi are documented on pages 49-71 of the Macintosh IIsi Developer Note, available on AppleLink and on the latest Developer CD Series disc.

### **Processor Direct Slot RAM access references**

Written: 11/1/90  
Last reviewed: 8/1/92

Please send us timing diagrams and any other useful information about accessing the RAM on the motherboard from the Processor Direct Slot (PDS) on the Macintosh IIsi and LC.

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You'll find the information you need in the Macintosh IIsi and LC Developer Notes, which are available through APDA (Apple Programmers and Developers Association). APDA is a membership organization for professional, advanced amateur programmers and developers who work on Apple equipment. Membership is open to anyone needing advanced tools and information for use in the development of Apple-compatible products. Dues are \$20.00 annually. Contact APDA for product information at 1-800-282-2732 or write

APDA  
Apple Computer, Inc.  
20525 Mariani Avenue, Mail Stop 33-G  
Cupertino, CA 95014.  
AppleLink®: APDA

You may also want to consult the 68020 and 68030 user's manuals, which are available from Motorola.

### **/NUBUS signal**

Written: 10/30/90  
Last reviewed: 8/1/92

What is the function of the /NUBUS signal (pin C2) on the Macintosh expansion connector of the Macintosh IIsi Processor Direct Slot?

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The /NUBUS signal can be used to start decoding the address lines, but in general it is of very little use.

## **/CPUCLK signal**

Written: 10/30/90

Last reviewed: 8/1/92

What are the termination and fanout specifications for the /CPUCLK signal on pin A38 of the DIN connector on the Macintosh IIsi Processor Direct Slot?

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There are no known problems with the /CPUCLK signal termination. The buffering available on the motherboard is rated for 1 TTL input. If you need more than you must provide the buffer yourself.

### **Macintosh Quadra Processor Direct Slot performance**

Written: 11/26/91

Last reviewed: 8/1/92

Do you have performance specs on the Macintosh Quadra's 040 Processor Direct Slot (PDS)? If it's a direct connection to the 040's processor bus, the maximum data transfer rate should depend on the speed of the RAM. Do you have a maximum transfer rate to RAM? Are there any known bugs in the Quadra's PDS?

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The maximum data transfer rate of the Quadra PDS depends on your mixture of reads and writes. The theoretical maximum is:

26 MBytes/sec for reads

36 MBytes/sec for writes

This maximum would be reached if all bus transfers were to/from DRAM, were bursts, and there was no arbitration for alternate bus masters going on.

We measured the bus activity when the bus was saturated, with data and instruction caches turned off. Since the caches were turned off, there were no burst transfers, and 93% of the accesses were reads. The observed bus throughput was 16 MBytes/sec. Why is this so much below 26 to 36 MBytes/sec? Because nonburst reads are 6-clock cycles and nonburst writes are 5 clock cycles. Also ROM accesses are slower than DRAM, as Apple use 150 nS ROM, compared to 80 nS DRAM. Typically half the instruction read accesses are to the ROM.

There are no known problems with the Quadra PDS.

### **Don't exceed Macintosh LC expansion card size specifications**

Written: 3/8/91

Last reviewed: 8/1/92

The Macintosh LC expansion card specifications are clear, but I'm wondering why a larger expansion card cannot be developed. It seems that a card with an "L" shape could be used to

increase the size of the board. There don't seem to be any restrictive components other than a large electrolytic capacitor which could be avoided. Are the restrictions due to heat or power considerations? What would Apple think about a card that was larger than the specifications if it was within the power budget?

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Making a larger or oddly-shaped expansion board for the Macintosh LC is not a viable alternative. Besides physical size limitations, blocking ventilation and air flow patterns, increasing the heat dissipation, and exceeding the power budget all become more acute because the Macintosh LC is designed with even less tolerance for “bending the rules” than any model before. Also, in designing upgrades to any Macintosh model, our engineers know not to violate the documented expansion space reserved for you. Likewise, your staying out of areas not defined for your use will eliminate conflicts with Apple’s upgrades.

The guidelines were set up to protect you and your product from an expensive exercise in incompatibility. Apple very much wants to see your product to be a success in the market place.

### **Dynamic bus sizing on the Macintosh IIfx PDS**

Written: 4/22/91

Last reviewed: 8/1/92

Referring to pages 312-3 of the second edition of Designing Cards and Drivers for the Macintosh Family, it seems the Macintosh IIfx handles PDS Pseudo NuBus differently between read and write cycles, and therefore does not support true 68030-style dynamic bus sizing. Could you please explain?

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To clarify Designing Cards and Drivers..., the paragraph with the wording about “cycles incoming to the Macintosh IIfx memory” on page 313 really refers to MASTER cycles incoming to the Macintosh IIfx memory. The memory controller will respond to masters reading IIfx memory with STERM (and only STERM) as a 32-bit port.

PDS slaves can use either DSACK or STERM—it’s your choice. DSACK is passed directly to the processor in this case. So the right thing should happen because the Macintosh IIfx circuitry is not altering your DSACK signals.

While there are buffers on the Macintosh IIfx connected to the PDS, they are only bi-directional buffers that flip one way or the other, depending on whether a read or write is happening. There is no byte-swapping.

The only differences between an Macintosh SE/30 card and the Macintosh IIfx are that the IIfx uses slot E and the PDS is a 20 MHz rather than a 16 MHz slot.

The only way to get on D0-D15 would be if a 16-bit cycle was made on a 32-bit port. Again, the Macintosh IIfx PDS doesn’t do anything funny with regard to slave accesses.

### **Macintosh SE expansion card must be parallel to motherboard**

Written: 3/8/91

Last reviewed: 8/1/92

The documentation for a Macintosh SE expansion card shows the board mounted parallel to the motherboard, but the chassis of the Macintosh SE which I have is the same as the one used on the Macintosh SE/30, whose expansion cards are mounted perpendicular to the motherboard. Is it possible to design an expansion card for the Macintosh SE following Macintosh SE/30 guidelines?



When hardware guidelines are set up, such as expansion board dimensions, power budgets, heat dissipation, Apple goes to great lengths to ensure that if you stay within these parameters your board will fit into every unit of that specification. This should remain true regardless of any manufacturing change to the unit and with all configurations of options.

The Macintosh SE internal chassis was changed in mid-production life to be interchangeable with the Macintosh SE/30 chassis. Although this appears to allow you to use the Macintosh SE/30 form factor on your expansion board, this is not the case. First, your board would not physically fit in all Macintosh SE systems because many have the original chassis. Second, there is no way for a user to tell which chassis s/he has, short of opening up the case. Third, even though the newer chassis does not block a vertical version of the board, other components used at various times in manufacture WILL block a vertical board in a Macintosh SE. The maximum allowable specifications for each model's expansion boards are detailed in *Designing Cards and Drivers for the Macintosh Family*, 2nd edition. If you design beyond these specifications, even if it seems to work in a specific Macintosh you own, it will not fit in all or even most of the other units within the same model. Mounting the card perpendicular to the motherboard on a Macintosh SE is not a viable option.

### **SE/30 expansion card form doesn't require square holes**

Written: 9/16/91

Last reviewed: 8/1/92

The small square holes at the top of the SE/30 expansion card depicted in Figure 15-9 of "Designing Cards and Drivers for the Macintosh Family," Second Edition, are not necessary. Their appearance in the diagram is probably a legacy of either an abandoned design approach or some fluke in the construction of the sample card used by engineering on which the diagrams were based.