NuBus power budget

You can determine the maximum current available to any NuBus card by dividing the maximum current available to the entire NuBus by the number of NuBus slots. For example, since a Macintosh II, Macintosh IIx, and Macintosh IIfx all have six NuBus slots, the maximum current available to any one NuBus card is one-sixth of that available to the entire NuBus. And since a Macintosh IIcx and a Macintosh IIci have only three slots, the maximum current available to any one NuBus card is one-third of that available to the entire NuBus. Worst case analysis for a fully loaded Macintosh computer, with equal current allocation to each of the slots, yields the recommendations in Table 5-7. A similar analysis, starting with the maximum capacitance for which the power supply operates reliably and subtracting the maximum capacitance on the main logic board, yields the card filter capacitance recommendations in the table.

◆ *Note:* The maximum current available to the entire NuBus in the Macintosh IIcx or Macintosh IIci computer is one-half of the maximum current available to the entire NuBus of a Macintosh II, Macintosh IIx, or Macintosh IIfx computer. Therefore, the calculated maximum current allocation to each of the three slots in a Macintosh IIcx or Macintosh IIci is the same as that shown in Table 5-7.

■ **Table 5-7** Recommended current and capacitance limits for a NuBus card

Nominal power supply value, V	Recommended maximum current per card (slot), A (continuous)	Recommended maximum capacitance per card, µF
+5	2.0	1513
+12	0.175	536
–12	0.150	698

◆ *Note:* The current analysis assumes a hard disk (1.8 A rms max) and two floppy disk drives (0.2 A typical) internal to the computer; if you choose to develop a card that exceeds these recommendations, you should make the end user aware of any limitations imposed on the system configuration.

The recommendations for maximum card capacitance are actual (not nominal) capacitance. You must allow for the capacitance tolerances of the particular capacitors being used in order to stay below the recommended maximum.

The power allowed in all Macintosh computers except the Macintosh Quadra 900 is 13.3 W per NuBus slot. The power supply in the Macintosh Quadra 900 is designed to provide additional current on the +5V outputs for the NuBus slots, compared with other Macintosh computers. The Macintosh Quadra 900 has enough power to support a total of two 25 W cards and three 15 W cards. The total power budget for NuBus cards in the Macintosh Quadra 900 shall not exceed 95 W.

If the amount of power used by NuBus expansion cards exceeds the total power budget, the Macintosh computer cannot be booted. During startup, the power supply attempts to turn itself on but cannot, and it continues the attempt over and over. When the computer is in this state, you must unplug it and remove the offending expansion cards.

However, some NuBus cards may inherently require more power. If your card contains a processor or a large amount of RAM, the card will probably need more power than is allowed for each expansion card. In the rare case when you do need to consume the power of multiple slots, you must make sure that the slot or slots adjacent to your card are not used. While there may be many ways to prevent the installation of an adjacent card, three possible solutions are provided here.

To prevent installation of an expansion card in an adjacent slot, you could create a mechanical barrier attached to your expansion card. Alternatively, you could design your NuBus expansion card as a multiple-card implementation. The NuBus cards could be connected via an internal bus, using ribbon cables or another type of connector. As a third suggestion, you could provide slot covers with your card. You must instruct the user to install slot covers over the necessary adjacent slots and warn them that they could damage their computers if the slot covers are not installed.

While all three suggestions solve the problem, there is one major drawback for the first two suggestions: if the power budget for future Macintosh computers changes, your card may no longer exceed the per slot power allocation. At that point, you may be wasting space and available NuBus slots. The third suggestion avoids this potential waste, as the slot covers would simply not be installed.

▲ **Warning** It is important that the 13.3 W power allocation not be exceeded for NuBus expansion cards in the Macintosh IIsi. Because the Macintosh IIsi has only one expansion slot, you cannot "borrow" excess power from other slots that may not be filled. Because the power supply in the Macintosh IIsi is designed to drive only a single card, however, a NuBus card that consumes more power than it is supposed to may damage itself and possibly the Macintosh IIsi. ▲