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# Technical Note HW17

## NuBus Physical Designs - Beware

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This Technical Note discusses the possible problems you might run into while designing a NuBus(TM) card. It covers some of the specifications which, if not followed, will have problems with current Macintosh machines, and possibly future machines.

[Jun 01 1989]

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## Introduction

If you are making a NuBus card for the Macintosh II family of computers, then you have to be very careful to follow the physical specifications which are listed in the NuBus specifications (IEEE P1196). There are two areas where some developers have run into problems. The first problem has to do with not positioning the external connector properly. The result is that some products have problems with the external hole on the back of the Macintosh IIcx. The second problem has to do with developers who run ribbon cables over the top of their boards to connect two boards. If a slot is not cut into the top of the board to allow the ribbon cable to sit below the top of the card, then the boards will have problems in our machines.

## External Connector

The NuBus specification allows for an external connector plastics opening of only 74.55 mm x 11.90 mm. The Macintosh II and IIx allowed a significantly larger hole than the specification (80.00 mm x 17.00 mm) and some developers incorrectly assumed that Apple would continue to allow for this larger size. When the Macintosh IIcx came out, these boards were incompatible, since the IIcx only allows for an external opening of 75.61 mm x 14.00 mm. This opening is still larger than the IEEE specification. We could shrink this size all the way to the limit of the NuBus specification in future machines. If you stay within the limits which are set down in the NuBus specification, then you should not have any problems with any of our machines.

There is one other important dimension which changed in the Macintosh IIcx; this is the intercard spacing. In the Macintosh II and IIx, the intercard spacing is set to the minimum space allowed by the NuBus specification (22.86 mm). In the Macintosh IIcx this dimension was expanded to 24.13 mm. Figure 1 shows the connector opening and intercard spacing for the Macintosh IIcx.

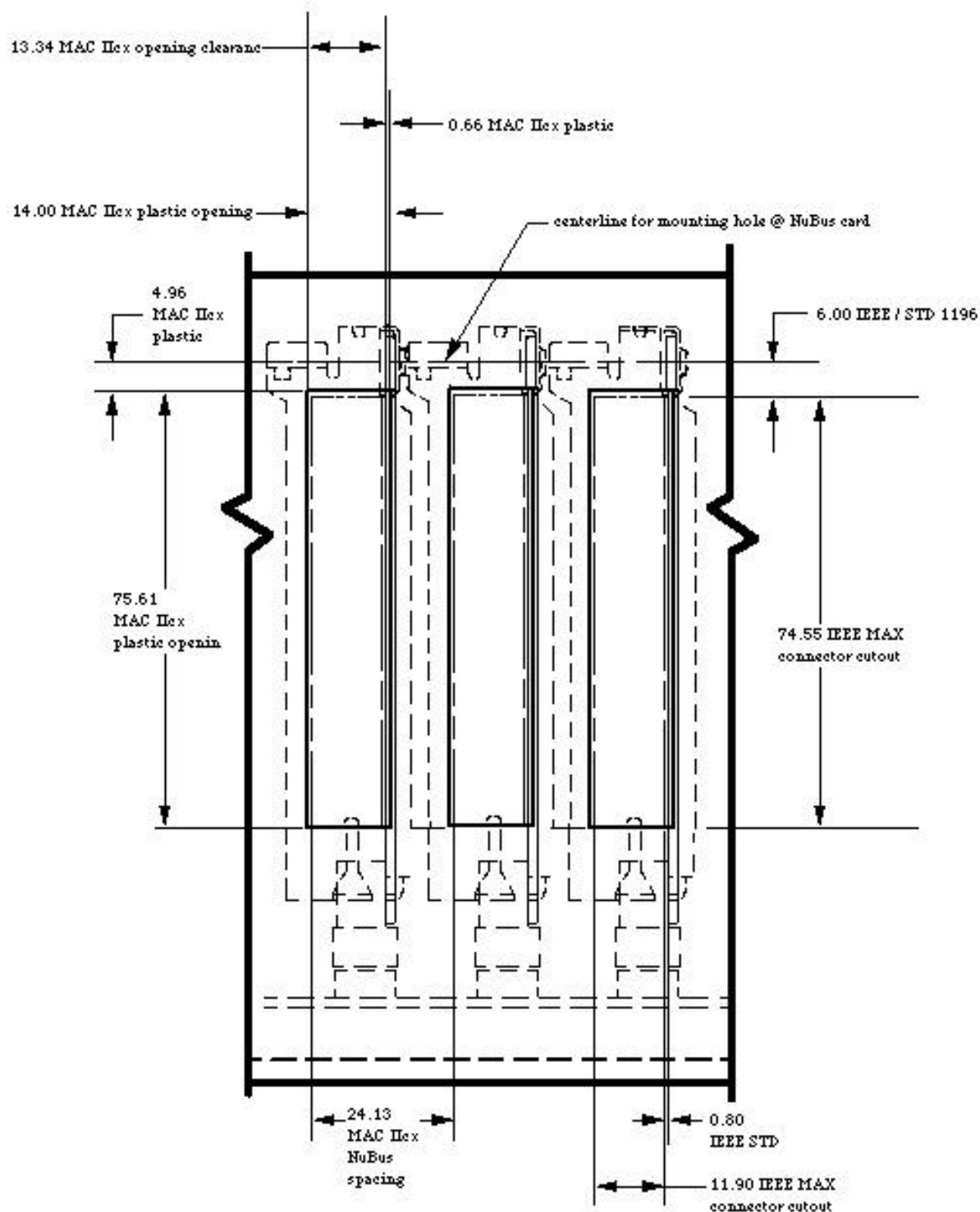


Figure 1 - Macintosh IIcx External Connector Opening and Inter-card Spacing

## Internal Connector

Several NuBus card developers have the need to connect two boards. The NuBus specification allows for this need with an auxiliary connector at the top of the card and next to the no component area. To connect the cards, you need to use a ribbon cable. The cable is run over the top of the card as demonstrated in Figure 2. The problem occurs when the ribbon cable is run over the top of a card and is not given a slot into which to drop.

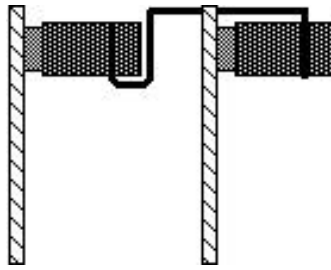


Figure 2 - Side View of Internal Connection

Figure 3 is an example of the **wrong** way to make your internal connector. The ribbon cable will not fit over top of the NuBus card; you must make a slot at the top of your card for the ribbon cable. Refer to Figure 4 for an example of the correct way to make your internal connector.

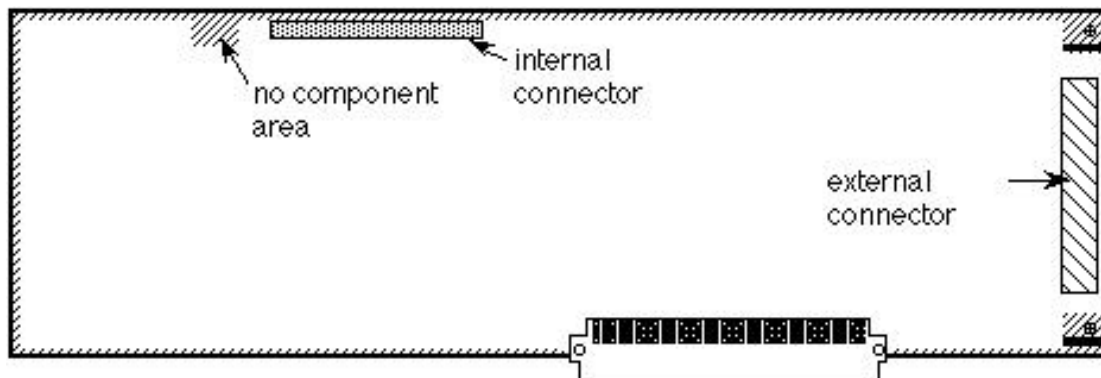


Figure 3 - The Wrong Way

If you cut a slot at the top of your NuBus card, you will not have problems with future Macintosh computers which utilize the NuBus standard. The slot needs to be deep enough for the cable to be flush with the top of the card.

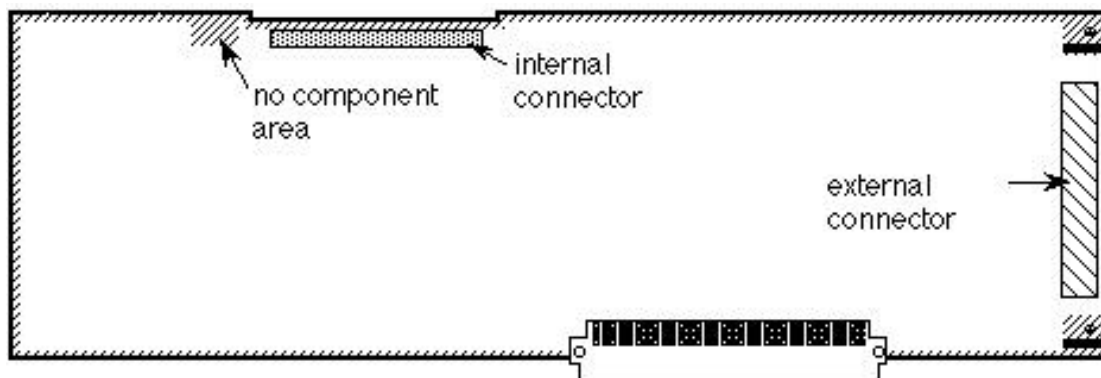


Figure 4 - The Correct Way

The internal connector must not have any parts which extend into the "no component area." This means that if your connector has lock & eject tabs (like the internal SCSI connector) then the tabs must be below the "no component area."

The no component area is defined as the area of the card onto which you cannot put any parts. The lid of the Macintosh II family of computers has two fingers which hold the NuBus cards into place. These fingers are needed for stability, and they help to ensure that the cards will not be damaged in the event that the computer is knocked around. If there are components in the no component area, then the fingers will either break the components, or the lid will not sit correctly.

## No Component Area

The no component area is not just an area in which you should not mount parts, but it is also a three-dimensional area. As such, the no component area covers the surface of the board as well as the distance to the next card (22.86 mm). This

means that you must not violate this space with either mounted parts or daughter boards.

## Full-Size NuBus Cards

It is important to test all full-size NuBus cards in the Macintosh modular platforms (e.g., Ilcx and Ilci). A full-size NuBus card extends 326.6 mm and might interfere with the NMI and reset buttons in these machines. Most cards should not have this problem, however, developers who find this problem with their cards should contact Developer Technical Support at the address listed in Technical Note #O.

## Conclusion

The moral of this story is that you should always follow the NuBus specifications which deal with the physical dimensions of your cards, even if Apple allows for more space in certain models of our machines.

If your board violates any of the NuBus specifications, or if you have run a ribbon cable over the top of your card, then you need to seriously consider redesigning your board.

## References

*NuBus--A Simple 32-Bit Backplane Bus P1196 Specification*

NuBus is a trademark of Texas Instruments

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