

PMC: The PCI Mezzanine Card

A standard mezzanine card design, PMC is based on the Peripheral Component Interconnect (PCI) standard bus, which has been universally adopted for use as a high-performance local bus in Pentium-based personal computers. With its further adoption as a mezzanine expansion bus for VMEbus, VME board makers are able to leverage off the economies of scale accruing to the personal computer industry.

This development also opens the flood-gate of compatibility with other types of computers such as workstations, industrial and commercial computers. This standard mezzanine bus has penetrated market areas which had previously remained proprietary, closely guarded or with high barriers to entry.

Mezzanine Cards

Mezzanine cards can satisfy three basic system design requirements:

- Provide a degree of flexibility to a host board such that a single host can be used in a variety of applications;
- Make it possible to stuff more components into a board's limited space;
- Add functions or enhancements to a board to extend product life.

Through the years, such cards have gone in and out of favor. Early add-on boards used what is by today's standards crude connector technology that was frequently prone to failure. In addition, there was often no mechanical support for the daughter boards other than the connectors.

But even as connectors improved, it was frequently considered a design goal to develop a board without add-ons. Boards with mezzanine expansion cards were looked upon as having design flaws and questionable reliability. However, there has been a universal change of thought about mezzanine board technology. Even the most adamant of the holdouts, the U.S. military, has grudgingly acknowledged the benefit of such approaches with a number of factors contributing to the turnaround in thought. And, if any holdouts remain, PCI/PMC is expected to make believers of everyone.

Previous Mezzanine Buses

One of the first steps toward bringing mezzanine cards to some level of respectability was their adoption by Intel, who accepted the simple I/O concept of iSBX. This standard bus provided 8-bit I/O with limited bandwidth.

A short time later, Intel introduced its higher-performance iLBX which could serve as a local bus for memory expansion. This bus was migrated to Multibus II in the mid-80s and remains in use in many Multibus systems today.

About the time of Multibus II introduction, VME board manufacturers developed their own proprietary buses because of incompatibilities between the Intel and Motorola processors.

Still later, Intel developed its MIX bus for Multibus II. The MIX bus has been successfully used by Pentek as an expansion bus for VME boards. For more information on the MIX bus, refer to the tutorial in this section.

The PCI Bus

PCI is a local bus that interfaces with the processor and memory bus on one side, while it provides a high-speed channel on the peripheral expansion side. Such a bus solves a variety of problems:

- It provides local connection for other buses, such as ISA, EISA, or VMEbus;
- It makes available simple means to implement I/O expansion;
- It eliminates the need for motherboard redesign with each processor revision.

The PCI specification is inherently high performance allowing transfer rates of 132 Mbytes/sec in its 32-bit implementation. Options using the 64-bit version



Pentek Model 7131 is a 16-channel digital receiver PMC module; it includes two A/Ds and a Virtex-II FPGA.

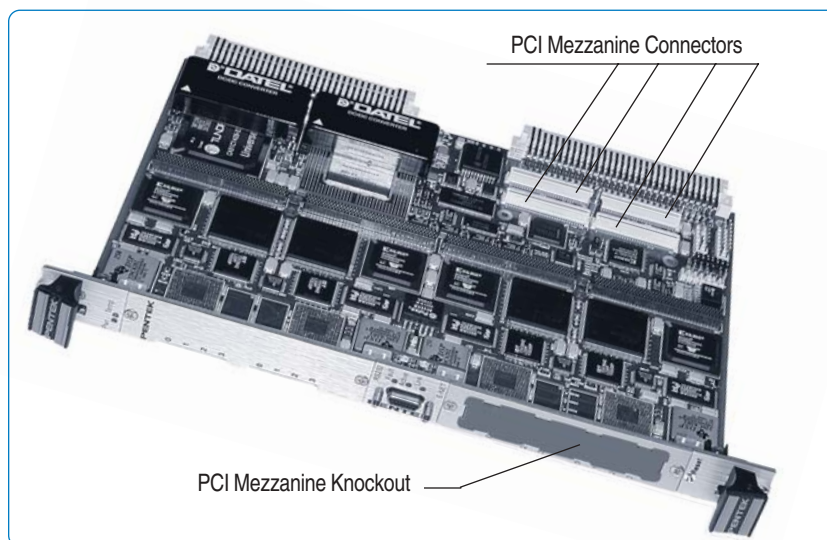


Figure 1. The Pentek Model 4292 shows the PCI connectors and front panel I/O knockout before the PMC module is installed.

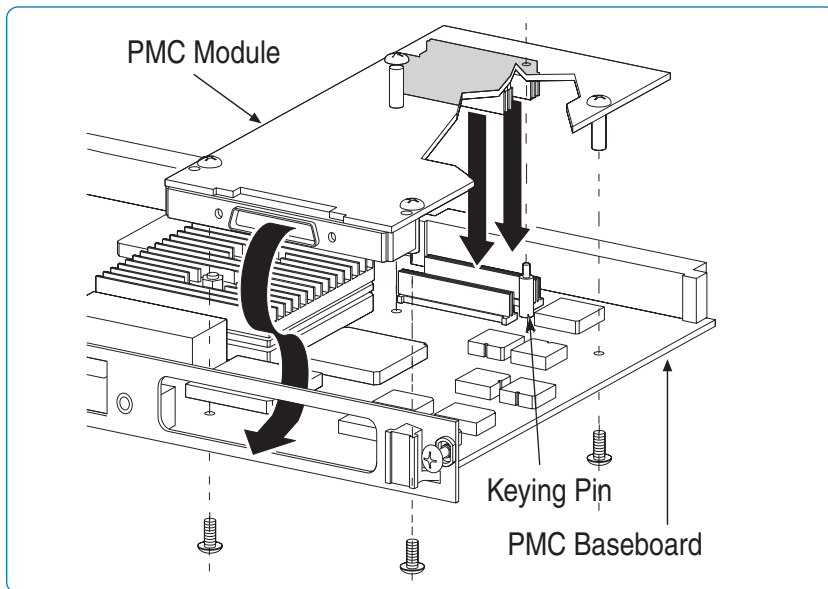


Figure 2. This figure illustrates how the PMC is installed on the VME board and shows the standoffs and mounting screws. Note how I/O can be taken directly out from the front panel through the PMC knockout. (Courtesy of Digital Equipment Corp.)

Pentek PMC Offerings

Pentek has introduced PMC modules which provide functions that utilize the same areas of expertise developed in our other module families. For instance, the Model 7110 C44 DSP coprocessor was our first coprocessor PMC module. Model 7131 brings our multichannel digital receiver expertise to the PMC platform.

Pentek has also introduced baseboards that accept one or two PMC modules. The Model 4285 Octal C40 VME board was our first PMC baseboard offering. The Model 4292 Quad C6203, the Model 4293 Octal C6203 and our latest Model 4205 I/O Carrier VME boards all accept VIM and PMC peripherals.

double that transfer rate. This kind of bandwidth brings PCI into the domain of very-high resolution graphics moving into the full motion video area. In addition, it lends itself to the new breed of high speed I/O such as Fibre Channel, ATM and FDDI.

The PMC specification, now known as IEEE P1386, defines the mechanical and electrical properties of the bus and the card. The physical size of the expansion card is roughly 3 x 5 inches, so it will fit comfortably on a 3U VME board. Two of them will fit on a 6U VME board, and four of them will fit on a Futurebus+ card. In addition, the height of the board and connectors are specified so that a PMC will fit in a single slot board, such as shown in Figure 1.

PMC I/O

I/O for the PMC is brought out the backplane on the P2 connector. In addition, the specification allows for direct connection to the front panel of the VME board.

A separate PMC front panel can protrude flush with the VME front panel through the knockout as shown in Figures 1 and 2. The pin connections have been specified to maximize signal integrity while assuring power distribution. For example, signal pins are guarded by ground or supply pins.

PMC Benefits

As an IEEE standard, PMC assures users that any host or module complying with the standard will function in any module or host that has been designed to the specifications. While this gives users the flexibility to mix-and-match different host cards with different option modules, it also gives vendors the ability to design basic host boards without special consideration to interface I/O. The fact that PMC is an open standard allows OEM's with nonstandard buses to take advantage of the same leverage as makers of standard buses.

The second advantage of using PMC is that it provides a large measure of stability. PMC provides a standard, high-performance local bus that will remain the same from processor to processor. Only the processor-to-memory bus need be modified.

Performance, of course, is another key element of PMC. New graphics and GUI's, extensive use of imaging, video and faster communications have placed a major demand on processor, I/O, and system bandwidth. PMC will go a long way to alleviate the I/O bottleneck. With a bandwidth of 132 Mbytes/sec for a 32-bit implementation and 264 Mbytes/sec for a 64-bit version, PMC is capable of handling just about everything up through ATM and full-motion video.

PCI and PMC put the focus on the main objective of the standard-bus community trying to provide a standard, off-the-shelf alternative to costly proprietary design. PMC will go a long way in providing that capability with a broad range of standard I/O.

VME will continue to drag along a large number of mezzanine cards with special functions. Some will be low-performance 8-bit I/O such as IndustryPack, others may be part of multiprocessing configurations. But there is little question that every system will include at least one or two PMC modules in the very near future. □

References

For more information on the PMC/PCI bus, refer to:

1. Digital Equipment Corporation White Paper: *PCI PMC: A Local Bus with Global Importance*, September 1994
2. Dick Somes and Wayne Adams, Digital Equipment Corporation: *A Case for the PCI Mezzanine Card Standard*, I&CS October 1995
3. IEEE P1386.1: *PCI Mezzanine Card*, IEEE Standards