The VIM® Family: High-Speed Mezzanine I/O Expansion Modules

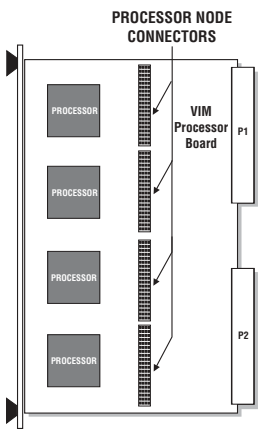

Figure 1. Pentek Quad C6000 or PowerPC VIM processor board.

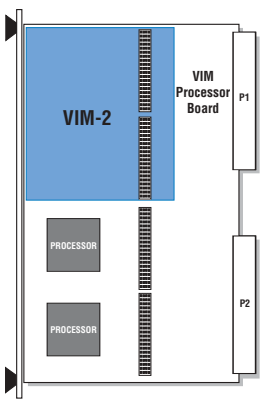

Figure 2. VIM-2 module (shown in blue).

During the last few years, the industry has witnessed the introduction of several fast DSP and RISC processors with impressive benchmarks for popular algorithms and sophisticated hardware engines for caching, moving data and addressing. These processors also support external data bus speeds that outstrip virtually every backplane available.

As an example, the Texas Instruments TMS320C6203 DSP executes eight 32-bit instructions in parallel within a 3.33 nsec instruction time, yielding 2400 MIPS operation. An on-chip multiple-path ALU and four-channel DMA controller are coupled to support extremely high-speed I/O peripherals. With dual 32-bit parallel data buses, it can move data to I/O devices at a combined speed of 1200 MB/sec.

The Motorola G4 AltiVec™ MPC7410 PowerPC running with a 400 MHz clock is capable of performing 20 operations per cycle. Using its external 64-bit data bus, it can handle peak I/O transfer rates to peripherals at 1067 MB/sec.

A New I/O Concept

Leading the I/O performance race, the VIM™ (Velocity Interface Mezzanine) specification was developed by Pentek to meet the needs of these high-speed processors. It provides a dedicated, up to 400 MB/sec, data channel to each of four processors on a quad processor 6U VMEbus board. Four 160-pin processor node connectors allow peripherals to deliver data directly to the private resources of each processor.

Some VIM module functions currently available include digital receivers and transmitters, high-speed A/D converters, and FPDP and RACEway interfaces. In all configurations, the processor board and the attached VIM modules occupy the same single VMEbus slot. The obvious benefits of VIM are the one-slot envelope, flexibility, higher density, lower cost, and much faster data transfer rates.

The Pentek VIM Family

This family of high-speed peripherals, branded VIM, includes high-performance I/O products and interfaces that allow direct connection to over 50 peripherals for real-time signal processing.

As stated previously, all VIM modules nest in the same slot as the processor board. Furthermore, they include an I/O-specific front panel. VIMs mate with the processor node connectors. Figure 1 depicts a simplified outline of the VIM processor board.

In order to provide the greatest flexibility and take advantage of the numerous interfaces of Pentek's VIM-compatible processor boards, VIM modules are offered in different sizes and formats.

VIM-2 Format

The VIM-2 format mates with the node connectors of two processors and is the most popular. Shown in Figure 2, it includes its own half-height front panel and is approximately 4.3 in. deep by 4.5 in. tall. The VIM-2 format allows two modules to be installed side by side, as shown in Figure 3. The two VIM-2 modules may be identical, thereby doubling the number of functions of one type of module. The two VIM-2 modules can also be different, bringing many more functions to this one-slot solution. This flexibility gives you the freedom to choose I/O interfaces that are very appropriate for each of your applications.

As an example, Model 6211 is a dual 65 MHz 12-bit A/D converter VIM-2 module. It may be combined with another Model 6211 to form a 4-channel A/D converter interface with each channel connected to one of the processors. Or, it may be combined with a different VIM-2 module such as a Model 6226 dual FPDP adapter. Combining the 6211 with the 6226 creates a board with two A/D channels plus two industry standard FPDP ports compatible with a wide range of system products.

VIM-4 Format

The VIM-4 module (See Figure 4) is equivalent to two VIM-2 modules. Its dimensions are approximately 4.3 in. deep by 9.0 in. tall, so it's twice as tall as a VIM-2 module. The VIM-4 module engages the processor node connectors of all four processors.

The increased real-estate and access to all four processors makes the VIM-4 format ideal for high-performance I/O peripherals, such as multichannel high-speed A/Ds and digital receivers. As in the case of the VIM-2 format, the VIM-4 module nests in the same slot as the processor board.

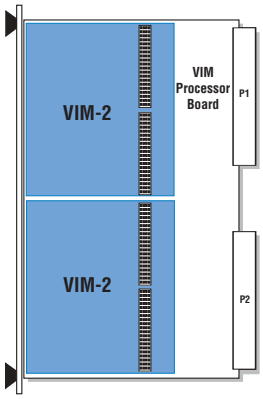

Figure 3. Two VIM-2 modules fit on the processor board while maintaining the one-slot configuration.

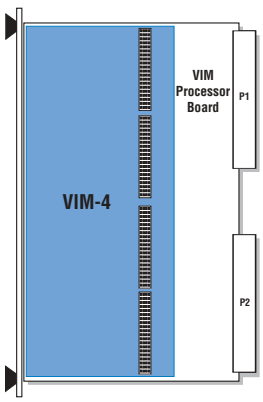

Figure 4. VIM-4 module.

The VIM processor boards reach mezzanine port I/O and interprocessor communication speeds of up to 400 MB/sec. Available VIM modules include:

- **A/Ds**
- **D/As**
- **Digital receivers with FPGAs**
- **Upconverters**
- **High-speed I/O such as FPDP**

Electrical Characteristics for Processor Node Interfaces (4 total)

The signal types, number of lines and direction (relative to the VIM module) are given below. All signal lines are compliant with TTL voltage levels.

Random Access V-Bus:
Data bits: 32 (in/out)
Address bits: 16 (in)
Read/Write enable: 2 (in)
R/W acknowledge: 2 (out)
Module select: 1 (in)
Reset: 1 (in)
Interrupt: 1 (out)
Module present: 1 (out)

Bidirectional FIFO:
Data bits: 32 (in/out)
Data clock: 1 (out)
FIFO status flags: 6 (in)
FIFO reset/enable: 2 (out)
FIFO read/write: 1 (out)
Interrupt mailbox: 3 (in/out)

Serial Ports (2):
Clock source: 2 (out)
Receive data: 2 (out)
Receive clock: 2 (in/out)
Receive frame sync: 2 (out)
Transmit data: 2 (in)
Transmit clock: 2 (in/out)
Transmit frame sync: 2 (out)

Power:
+5 V: 20 pins, 1 A max.
+12V: 1 pin, 0.5 A max.
–12V: 1 pin, 0.5 A max.
GND: 23 pins

Connector:
Processor board: 160-pin female, gold, Samtec SOLC-140
VIM Module: 160-pin male, gold, Samtec TOLC-140

VIM MEZZANINE I/O MODULES FOR VMEbus [1]			
Model	Description	Slots Used[2]	VIM Type
6210	Narrowband Digital Receiver, Demod. and A/D	1	VIM-2
6211	2-Channel 12-bit 65 MHz A/D Converter	1	VIM-2
6215	8-Channel 16-bit A/D Converter	1	VIM-2
6216	Wideband Digital Receiver and A/D	1	VIM-2
6223	C40 Comm Port Adapter	1	VIM-2
6226	Front Panel Data Port (FPDP) Adapter	1	VIM-2
6227	Parallel Digital I/O	1	VIM-2
6228	Digital Upconverter with D/A and FPGA	1	VIM-2
6229	Digital Upconverter and D/A	1	VIM-2
6230	32-Chan. Narrowband Receiver, A/D & FPGA	1	VIM-4
6231	16-Chan. Narrowband Receiver, A/D & FPGA	1	VIM-2
6232	32-Chan. Narrowband Rcvr, FPGA & FPDP inputs	1	VIM-4
6235	Dual Wideband Digital Receiver with A/D & FPGA	1	VIM-2
6236	Dual 105 MHz 14-bit A/D with optional Receivers and FPGA	1	VIM-2
6250	Configurable Logic FPGA with FPDP I/O	1	VIM-2
6251	Configurable Logic FPGA with FPDP I/O	1	VIM-2

Table 1. VIM one-slot I/O solutions.

[1] VIM modules are described fully in Section 7
[2] Including the VIM module and the processor board

VIM-COMPATIBLE PROCESSOR BOARDS FOR VMEbus[1]	
Model	Description
4205	Single MPC7451 PowerPC Processor PMC/VIM-compatible VME Board
4290	Quad TMS320C6201 Processor VIM-compatible VME Board
4291	Quad TMS320C6701 Processor VIM-compatible VME Board
4292	Quad TMS320C6203 Processor PMC/VIM-compatible VME Board
4293	Octal TMS320C6203 Processor PMC/VIM-compatible VME Board
4294	Quad MPC7410 PowerPC Processor VIM-compatible VME Board
4295	Quad MPC7410 PowerPC Processor PMC/VIM-compatible VME Board

Table 2. VIM- and PMC-compatible processor baseboards.

[1] Processor Boards are described fully in Section 6

PENTEK
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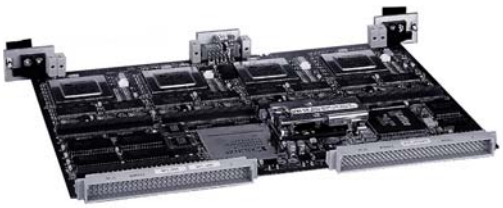
www.pentek.com

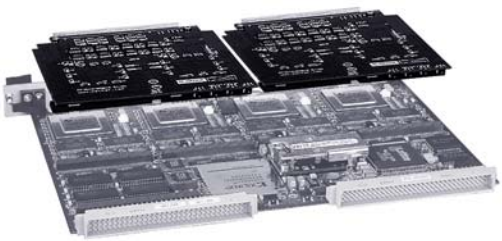
Attaching VIMs to Processor Boards

Model 6235 is a dual wideband digital receiver VIM-2 module; it includes two A/Ds and one FPGA for custom signal processing.

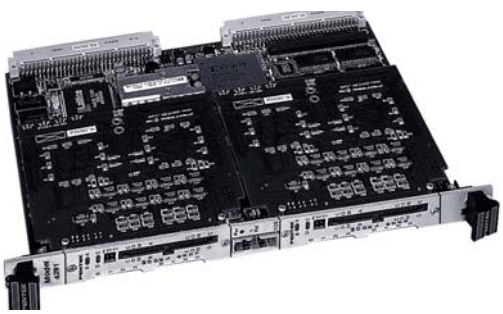


The Pentek Model 4291 Quad C6701 Processor board, as viewed from the rear of the board, without any VIM modules attached.

The Model 4292 Quad C6203 Processor board. A Model 6210 VIM module is attached to the upper part of the board and a Model 7110 PMC module to the lower part of the board.



Pentek VIM modules attach directly to the processor board through the I/O connectors. Shown here are two Model 6223 Comm Port Adapter VIM-2 modules in the process of being plugged into a Model 4291 Quad C6701 Processor board as viewed from the rear of the board. Two different modules may be used to provide more I/O functions.



The two VIM-2 modules are now fully inserted into the I/O connectors of the Model 4291 Quad C6701 Processor board. Shown here is the completed assembly as viewed from the front. The front panels of the two modules have become part of the front panel of the 4291 processor board.

C6000, PowerPC and VIM I/O are perfect solutions to high-performance applications in audio, sonar, radar, speech recognition, and beamforming. For more information, refer to Section 6 of this catalog and to: www.pentek.com/VIMCentral/vimspec.cfm