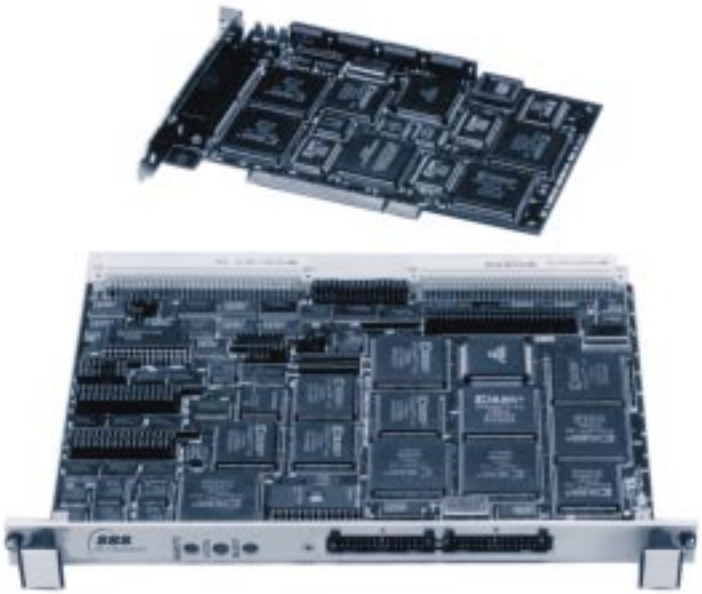
MODEL 617
PCI - VMEbus Adapter with DMA

SBS Bit 3's Model 617 adapter with DMA connects a PCI computer and a VMEbus system for fast, cost effective sharing of memory and special purpose boards. With Model 617 you can use a standard PC or workstation instead of a single board computer so that you can take advantage of a wealth of off-the-shelf software, the latest processor technology, and worldwide support from major PC, workstation, and operating system manufacturers. Consequently, effectively speeding your development effort and reducing time to market.

The adapter provides high-speed data transfers between systems, and requires minimal software support.

Linked by the Model 617, these two powerful computing environments become even more powerful and versatile. From the VMEbus side of the adapter, you can take full advantage of PCI system resources for VMEbus applications. And, because the adapter card is treated as any other processor on the VMEbus, the PCI system acting through the adapter can function as either a coprocessor or as the only bus master processor on the VMEbus. Consequently, the PCI system can directly control and monitor a wide variety of VMEbus cards and high- performance processors, as well as exchange interrupts with the VMEbus.



Adapter With DMA Connects A PCI System To A VMEbus System

The Model 617 allows each bus to operate independently. The timing of the PCI bus and VMEbus is linked only when a memory or I/O reference is made to an address on one system that translates to a reference on the other. The integrity of the interface between adapter cards is maintained by parity checks on address, control and data lines.

Model 617 supports bidirectional random access bus mastering from either system and also supports 16- and 32-bit data transfers using a built-in DMA Controller. The DMA Controller is a high-speed data mover engine that moves data between PCI system memory and the VMEbus at sustained data transfer rates up to 26 Megabytes per second (M Bytes/sec). It also allows a VMEbus DMA device (such as a disk controller) to DMA through the adapter directly into PCI memory at data transfer rates in excess of 10M Bytes/sec.

Device drivers compatible with the following operating systems are provided with the adapter: AIX™, Solaris™ 2.0, Windows 95™, and Windows NT™.

Other SBS Bit 3 adapters, supporting a wide variety of buses, can be used with Model 617 adapters to connect multiple computers and systems in star, daisy-chain or modified star/daisy-chain configurations.

Communications Between PCI Bus & VMEbus

Model 617 supports two methods of intersystem communications: Memory Mapping and Direct Memory Access (DMA).

Memory Mapping controls random access (PIO transfers) to remote bus RAM, dual-port memory, and remote bus I/O, and provides an easy-to-use, flexible interface with low overhead. PCI bus master can access memory in the VMEbus system through a window in PCI address space. Conversely, a VMEbus bus master can access PCI memory from a window in VMEbus address space.

Memory RAM Registers are used to steer accesses in 4K byte segments from PCI address space to VMEbus address space. The contents of the 8,192 PCI to VMEbus Mapping RAM Registers identify the VMEbus address, the address modifier code, and the option of byte or word swapping.

Likewise, 4,096 32-bit Mapping RAM Registers are available to map accesses from VMEbus bus masters onto the PCI bus. In addition, there are 4,096 32-bit DMA to PCI Mapping RAM Registers.

Memory Mapping also controls access to dual-port memory Dual Port RAM, an optional card installed on the VMEbus adapter card, provides a memory buffer; saves the cost of additional memory cards; and requires no additional VMEbus card slots.

Optional Dual Port RAM provides shared memory space accessible by random access reads and writes from either system. Dual Port RAM access uses only the bandwidth of the accessing bus. Consequently, data can be exchanged with minimal impact on the performance of the other system's bus. Both systems can access Dual Port RAM simultaneously; the adapter arbitrates accesses.

Dual Port RAM cards now available from SBS Bit 3 include: 32K, 128K, 1M, 2M, 4M, and 8M byte cards.

DMA, the other method of communication, is the automatic transfer of data from one memory address to another. The Model 617 supports two DMA techniques: DMA Controller Mode and Slave Mode DMA.

DMA Controller Mode uses the adapter's DMA Controller to enable high-speed data transfers from one system's memory directly into the other system's memory. Data transfer in either direction can be initiated by the PCI or VMEbus processor. Each DMA cycle supports transfer lengths up to 16M bytes. The DMA Controller also allows data transfers between PCI memory and Dual Port RAM on the VMEbus adapter card.

In Slave Mode DMA, the adapter card appears as a slave memory card. This type of DMA transfer is performed when a VMEbus DMA device (such as a disk controller) transfers data through the adapter directly into the PCI system.

Interrupt & Error Handling

The adapter supports interrupts from four sources:

- Pending VMEbus interrupts IRQ1 - IRQ7.
- Programmed interrupts to the PCI system (PT interrupts).
- Interface error interrupts activated when a timeout, parity error, or bus error condition is detected on an adapter card.
- DMA Done Interrupt .

Up to seven interrupts can also be sent from the VMEbus system to the PCI bus. These interrupts are selected from eight possible sources: IRQ1 - IRQ7 and the PT interrupt.

Although there are several potential VMEbus interrupt sources, only one PCI interrupt signal is used. Therefore, an 8-bit status register and an interrupt control register are available for the PCI interrupt handling routine to use to determine the VMEbus interrupt source.

Two interrupt sources, PT and PR interrupts, can be generated from the PCI adapter card and sent to the VMEbus.

System Controller Mode Capability

In addition to VMEbus control and bus master capabilities, the adapter can provide system controller functions. If the VMEbus system is used primarily as an expansion chassis for the PCI system, System Controller Mode eliminates the need to purchase an additional VMEbus system controller.

When configured as the system controller, the adapter provides the VMEbus system clock and system reset, and the Bus Error (BERR) global timeout. The VMEbus adapter card may be configured to be a Single-Level (SGL) bus arbiter or a four-level bus arbiter in Priority (PRI) or Round-Robin (RRS) Mode.

Mapping Registers

All accesses from PCI to VMEbus, except adapter I/O registers, are through Mapping RAM. Each of the 8,192 Mapping RAM Registers controls access to 4K bytes of VMEbus address space. If all 8,192 Mapping RAM Registers point to different 4K byte VMEbus addresses, a total of 32M bytes of PCI address space can be mapped to the VMEbus.

Likewise, 4,096 Mapping RAM Registers are available for mapping random accesses and Slave Mode DMA accesses originating on the VMEbus into PCI address space. The remaining upper 4,096 Mapping RAM Registers provide the DMA Controller Mode address control for either PCI or VMEbus initiated DMA transfers.

Because the PCI environment provides demand-paged virtual memory, a contiguous buffer is not guaranteed to reside in contiguous pages when it is present in physical memory. Mapping RAM Registers on the PCI adapter card provide a mechanism that allows discontiguous PCI physical pages to be accessed from a contiguous VMEbus address window, or to appear contiguous for DMA operations.

Technical Highlights

- Random access reads and writes from the PCI system to the VMEbus.
- Random access reads and writes from the PCI bus to Dual Port RAM.
- Random access reads and writes from the VMEbus to the PCI bus.
- Flexible mapping of PCI bus address space to VMEbus memory and I/O address space.
- Accesses from the PCI bus to the VMEbus are A32, A24, or A16; data accesses are 32-, 16-, or 8-bit.
- Accesses from the VMEbus to PCI bus are A32; data accesses are 32-, 16-, or 8-bit.
- 32-bit and 16-bit Block Mode transfers are supported.
- Accesses from the VMEbus to Dual Port RAM are A32 or A24; data accesses are 32-, 16-, or 8-bit; Block Mode transfers are supported.
- DMA Controller Mode and Slave Mode DMA.
- DMA modes support Dual Port RAM.
- DMA data transfers from chassis to chassis at sustained rates up to 26M Bytes/sec.
- Provides Byte Swapping and Word Swapping functions.
- VMEbus adapter card can function in System Controller Mode.
- Add up to 8M bytes of shared memory via optional Dual Port RAM cards.
- Interrupts can be passed from the VMEbus system to the PCI system.
- Parity checking on address, control and data lines on the PCI adapter card and on the interface between adapter cards.
- Power requirements - The VMEbus adapter card draws 3.5A at 5V. The PCI adapter card draws 1.5A at 5V.
- Environment - Temperature: 0^{o} to 60^{o} C operating; -40^{o} to 85^{o} C storage. Humidity: 0% to 90% non-condensing.
- 6U to 9U Holders are available as an option.
- VMEbus adapter card meets IEEE 1014C specifications.

Model 617 Adapter

Support Software Components

- Model 924 AIX, Model 945 Solaris 2.0, Model 973 Windows 95 or Model 983 Windows NT compatible device driver.
- Example programs demonstrating:

  How to map remote bus and dual-port memory into an application's memory space.

  Read and write functions.

  Requirements for sending/receiving interrupts.

  How applications use the device driver to process programmed and error interrupts.

  Requirements for receiving and processing interrupts generated on the remote bus.
- Tools for installing the device driver.
- Documentation.

Required Components

One short form factor PCI adapter card.

One 6U VMEbus adapter card.

A round EMI-shielded copper-conductor cable to connect adapter cards (purchased separately from SBS Bit 3 so that you can specify the appropriate length and type for your installation).

Each Model 617 package contains: one PCI adapter card, one VMEbus adapter card, Support Software, and a manual.

Dual Port RAM

32K byte	Model 400-201	128K byte	Model 400-202
1M byte	Model 400-203	2M byte	Model 400-204
4M byte	Model 400-205	8M byte	Model 400-206

Cable *(one required)*

8' Round EMI-Shielded	Model 400-107
25' Round EMI-Shielded	Model 400-108
Bulkhead connector configurations	Contact SBS Bit 3 for configurations

Fiber-Optic Interfaces

Cards: Two Fiber Card Model 400-5; Four Fiber Card Model 400-6.

Modules: Two Fiber Module Model 400-50; Four Fiber Module Model 400-60.

(Fiber-Optic Cards are for the VMEbus system only; Modules may be used with either the PCI or VMEbus system. Two Fiber-Optic Interfaces are required.)

SBS Bit 3 Operations
1284 Corporate Center Drive, St. Paul, MN 55121-1245
Tel (651) 905-4700 • Fax (651) 905-4701 • Email info@bit3.com • Web www.bit3.com

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