MODEL 618

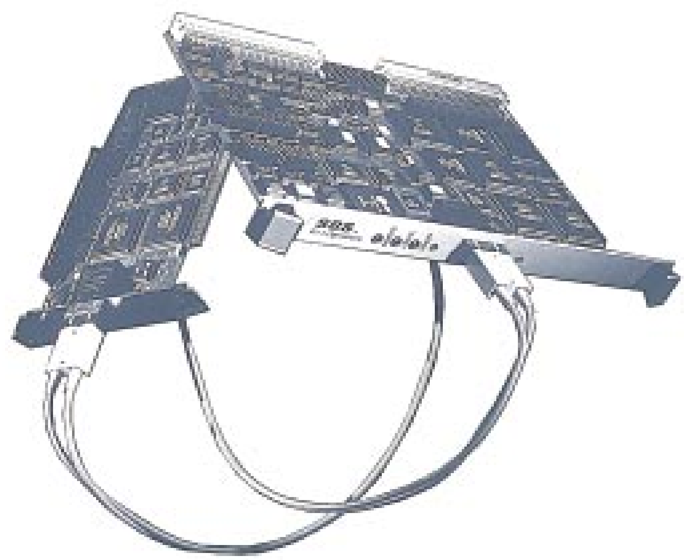
VMEbus - PCI Adapter with DMA

Model 618 -- the next generation for SBS's market accepted and widely used Model 617 adapter -- is the most cost-effective solution for applications requiring VMEbus to PCI connectivity and fiber-optic capabilities. By eliminating the need for Fiber-Optic Interface Modules, Model 618 provides the benefits of fiber-optics and increases system reliability. Fewer components are required for fiber-optic capabilities than with Model 617. Plus, applications written for Model 617 can easily port to Model 618.

With Model 618 you can use a standard PC or workstation instead of a single board computer letting you 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.

Model 618's fiber-optic features make it ideal for environments requiring noise immunity, high-performance, electrical safety, isolation and long-distance system separation (up to 500 meters).

Model 618 allows you to share memory and special purpose boards between a PCI Local Bus computer and a VMEbus system. The adapter provides high-speed data transfers between systems, and requires minimal software support.



Adapter With DMA Connects A VMEbus System To A PCI System

Linked by the adapter, 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.

The adapter 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.

Model 618 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

35 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 15M Bytes/sec.

Device drivers compatible with the following operating systems are provided with the adapter: Solaris™, IRIX™, Windows 95 & 98™, HP-UX™, Windows NT™, and VxWorks™.

Communications Between PCI Bus & VMEbus

Model 618 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. A 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 include: 128K and 8M byte cards.

DMA, the other method of communication, is the automatic transfer of data from one memory address to another. The Model 618 supports two DMA techniques: Controller Mode DMA and Slave Mode DMA.

Controller Mode DMA 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, fiber-optic data error, or bus error condition is detected on an adapter card.
- The DMA Done Interrupt that is activated when the Done Interrupt enable bit is set and a DMA operation ended. The interrupt remains active until cleared by clearing the DMA Done bit or by starting another DMA operation.

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 Model 618 can provide the 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.
- 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.
- Local and remote loopback diagnostic function for PIO data transfers.
- Controller Mode DMA and Slave Mode DMA.
- 32-bit and 16-bit Block Mode transfers are supported (Controller Mode DMA only).
- DMA modes support Dual Port RAM.
- DMA data transfers from chassis to chassis at sustained rates up to 35M 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.

Model 618 Adapter

Technical Highlights *continued*

- 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.
- Data checking on the fiber-optic interface between adapter cards.
- Power requirements - VMEbus adapter card draws 3.5A at 5V; PCI adapter card draws 2.5A at 5V.
- Environment - Temperature: 0^{o} to 60^{o} C operating; -40^{o} to 85^{o} C storage. Humidity: 0% to 90% non-condensing.
- VMEbus adapter card meets IEEE 1014C specifications.
- PCI adapter card meets PCI Local Bus Specification 2.0.

Support Software Components

- Compatible device drivers for: Pentium platforms - Model 973 (Windows 95 & 98) and Model 983 (Windows NT); HP PCI platforms - Model 934 (HP-UX 10.20); Silicon Graphics PCI platforms - Model 965 (IRIX 6.5); Sun platforms - Model 945 (Solaris), and Intel-based PCI platforms - Model 993 (VxWorks).
- 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 fiber-optic cable to connect adapter cards (purchased separately from SBS so that you can specify the appropriate length and type for your installation).

Each Model 618 package contains: one PCI adapter card, one VMEbus adapter card, Software Drivers CD-ROM, and a manual.

Dual Port RAM

128K byte	Model 400-202	8M byte	Model 400-206

Fiber-Optic Cable *(one required)*

10 meter	Model 15-101	25 meter	Model 15-102	5 meter	Model 15-103
50 meter	Model 15-104	100 meter	Model 15-105		

Custom cable available in lengths up to 500 meters.

618-9U

Model 618 adapter with VMEbus adapter card mounted in a 9U Holder.

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