# Model 618-3/620-3

## VMEbus to PCI Adapters with DMA

I/O & Communications

## Features

- Bi-directional bus mastership
- Memory and I/O mapping
- Controller Mode DMA: 35 MB/s
- Slave Mode DMA: 13 MB/s
- DMA modes support Dual Port RAM
- VMEbus System Controller Mode
- Byte and word swapping functions
- Cable interface supports fiber-optic cable up to 500 meters
- IRQ1-7 and two programmable interrupts can be passed across cable
- Parity checking on address, control and data lines (PCI card)
- Data checking on the interface between cards
- 128 KB and 8 MB optional Dual Port RAM available for VME adapter card
- Loopback diagnostics for PIO transfers (618-3 only)
- Supports both 3.3V and 5.0V signalling

**Model 618-3 and 620-3** bus adapters are cost-effective solutions for applications requiring VMEbus to PCI connectivity and fiber-optic capabilities. SBS bus adapters directly connect the VMEbus and PCI bus creating a virtual bus that allows the two systems to operate as one, enabling seamless operation, superior performance and the combined benefits of two diverse systems.

A standard PC or workstation can be used with the 618-3/620-3 bus adapter instead of a single board computer allowing the user to 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. As a result, time to market and the overall development cycle are greatly reduced.

Because of their fiber-optic features, 618-3/620-3 bus adapters are ideal for environments requiring noise immunity, high-performance, electrical safety, isolation, and long-distance system separation (up to 500 meters).

The comprehensive suite of software drivers provided with 618-3 and 620-3 bus adapters minimizes integration time. In most cases, applications can be up and running in a few days. Drivers for Solaris™, IRIX™, Windows® 95, Windows® 98, Windows NT®, VxWorks®, Linux®, and HP-UX are available with these bus adapters.

# Model 618-3/620-3

Model 618-3/620-3 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 support.

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. Therefore, bus bandwidth is not affected during non-transfer periods.

The adapter supports bi-directional 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 (MB/s). 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 13 MB/s.

## Communications PCI Bus ↔ VMEbus

618-3/620-3 bus adapters support two methods of intersystem communications: Memory and I/O Mapping, and Direct Memory Access (DMA).

Transparent connectivity in which the address space of the destination bus appears as additional address space to the host bus is achieved via memory and I/O mapping. Mapping takes defined address ranges of unused memory on the host bus and transposes it to selected global memory address space and I/O on the destination bus. Once the mapping is created, there is no further software overhead; adapter and system hardware handle everything.

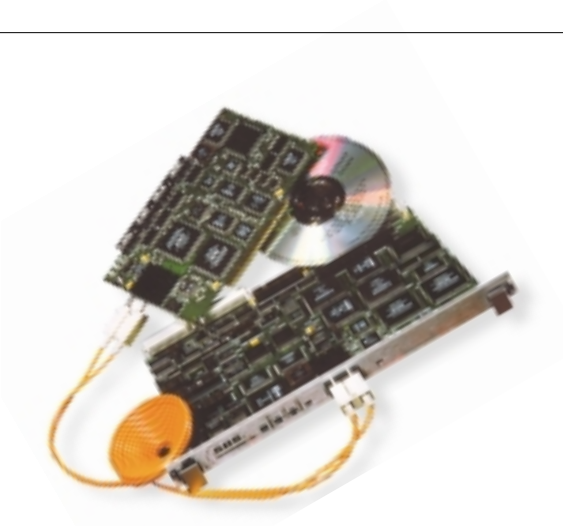
The SBS bus adapters provide bi-directional bus mastership in which address mapping is possible from both buses. Adapter memory mapping hardware allows discontiguous remote addresses to be mapped to contiguous local host addresses.

Memory mapping uses simple C language pointers to access remote resources. Any remote address space or address can be memory mapped.

DMA, the other method of communication, allows large blocks of data to be moved between the two systems at high speed with little processor overhead. The DMA engine reads data from one bus and writes data to the other bus. When the transfer is complete, the adapter interrupts the processor.

Two DMA modes are supported: Controller Mode DMA and Slave Mode DMA. Controller Mode DMA uses the adapter's DMA controller to enable high-speed transfers from one system's memory directly into the other system's memory. The local or remote processor can initiate data transfer in either direction. The DMA controller allows data transfers between PCI memory and Dual Port RAM on the VME adapter card. To achieve the best performance, VME block mode is used. A pause mode that allows other VME masters more frequent access to the VME bus during DMA is also available.

SBS Support Software, provided with the adapters, automatically engages the DMA engine for all reads or writes that are long enough to benefit from a DMA transfer.



Slave Mode DMA is the process by which a VME device uses the adapter to transfer a block of data directly into the host's memory. Slave Mode DMA transfers use the adapter's FIFOs to boost throughput to 13 MB/s. Like Controller Mode DMA, Slave Mode DMA uses very little host processing power during the transfer; the VME device actually performs the transfer and the adapter performs all host page manipulation. A programmed or VME device interrupt can be used to alert the host process when the Slave Mode DMA transfer is complete.

Because most operating systems use a memory manager, the user's buffer may be scattered across physical memory. The adapter hardware allows contiguous VME data to be transferred into the discontiguous host buffer. This feature is essential for Slave Mode DMA.

## Interrupts Across the Cable

Interrupts can be passed directly between the two buses. All seven VME interrupts, IRQ1 – IRQ7, can be monitored and acknowledged from the host system. Consequently, the host system can be asynchronously notified when a VME card requires servicing and the need to poll is eliminated.

The 618-3 and 620-3 bus adapters support two programmed interrupts that can be used to communicate between host and remote processes. Adapter hardware status is monitored by an error interrupt that eliminates the need to poll the adapter for errors.

## System Controller Mode Capability

In addition to VMEbus control and bus master capabilities, the adapter can provide slot 1 system controller functions. In most cases, configuring the adapter to perform system controller functions and installing it in slot 1 eliminates the need for an additional VME system controller. The adapter also allows the host to reset the VMEbus so that a system failure can be remotely reset.

In System Controller Mode, the adapter provides the VME system clock and system reset, and the bus error global timeout. The adapter card also provides four-level priority, four-level round-robin, or single-level bus arbitration.

## Dual Port RAM

Up to 8 MB of optional shared memory, Dual Port RAM, can be added to the VME adapter card. Dual Port RAM does not require access to the other bus; consequently, providing system and limiting bandwidth use to only the accessing bus. Memory mapping and both DMA modes support Dual Port RAM. Arbitration is handled by the card itself.

## Support Software Components

| Compatible Device Drivers for: | |
|---|---|
| Pentium Platforms | Model 973 - Windows 95 & 98<br>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 946 - Solaris |
| Intel-based PCI Platforms | Model 993 - VxWorks<br>Model 1003 - Linux |

**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, and processing interrupts including those generated on the remote bus
- How applications use the device driver to process programmed and error interrupts

**Tools for Installing the Device Driver**

**Documentation**

## Software Drivers

**Logical devices:**
Multiple adapters can be installed in a single host system. The device driver separates each physical adapter unit into several windows that are each treated as a logical device with a separate device name. One logical device is allocated to each of the following windows:

- Dual Port RAM address space
- I/O space on the remote bus
- Remote bus 24-bit memory located in the range 0x00000000 to 0x00FFFFFF
- Remote bus memory located in the range 0x00000000 to 0xFFFFFFFF
- Local system memory accessed from the remote system

**DMA functions:**
The device driver, for Controller Mode DMA, automatically engages the adapter's DMA engine for all reads and writes that will benefit from a DMA transfer. Slave Mode DMA transfers must be serialized through the driver.

**Interrupts:**
The device driver includes an interrupt handler for status error, programmed, DMA, and remote bus interrupts. Interrupt processing is controlled by interface commands that register to receive notification of an interrupt, and that allow user written remote bus interrupt handlers to be incorporated.

**Interrupt call backs:**
Applications can register functions that are called when error, programmed, or remote bus interrupts occur.

**Atomic instruction emulation:**
Atomic Test & Set (TAS) and Atomic Compare & Swap (CAS) are emulated on the bus adapters. TAS provides an indivisible or interlocked test and set operation on either the remote bus or remote Dual Port RAM. CAS provides an indivisible or interlocked transaction on the remote bus or to remote Dual Port RAM. Both functions are useful for accessing a semaphore on the remote bus or remote Dual Port RAM, and for coordinating communication between the two systems.

**Control & configuration:**
Device control and configuration commands are supported. They are used to customize the device driver for your specific environment.

# Model 618-3/620-3

## Specifications

**Model 618-3/620-3 Package Contains:**
- One PCI adapter card
- One VMEbus adapter card
- Software drivers CD-ROM
- Manual

**Required Components**
- One short form factor PCI adapter card
- One 6U VMEbus adapter card
- A fiber-optic cable to connect adapter cards (purchased from SBS as separate item so that you can specify length and type for your application)

**Power Requirements**
- VMEbus adapter card draws 3.5A at 5V
- PCI adapter card draws 2.5A at 5V

**VMEbus Adapter Card**
- Meets IEEE 1014C specifications

**PCI Adapter Card**
- Meets PCI Local Bus Specification 2.0

**PCI bus to VMEbus**
- Accesses: A32, A24, or A16
- Data accesses: 32-, 16-, or 8-bit

**VMEbus to PCI bus**
- Accesses: A32
- Data accesses: 32-, 16-, or 8-bit

**VMEbus to Dual Port RAM**
- Accesses: A32 or A24
- Data accesses: 32-, 16-, or 8-bit
- Block Mode transfers are supported

**Temperature**
- Operating: 0° to 60° C
- Storage: -40° to 85° C

**Humidity**
- 5% to 90%, non-condensing

## Configurations

| Model Number | Configuration |
|---|---|
| 618-3 | VMEbus - PCI adapter with DMA and loopback diagnostics |
| 618-9U | Model 618-3 adapter with VMEbus adapter card mounted in a 9U holder |
| 620-3 | VMEbus - PCI adapter with DMA |
| P32F-1-3 | 620-3 PCI card only |
| P32F-3 | 618-3 PCI card only |
| V32F-1-3 | 620-3 VME card only |
| V32F-3 | 618-3 VME card only |
| ***Dual Port RAM Options*** | |
| Model 400-202 | 128 Kilobytes |
| Model 400-206 | 8 Megabytes |
| ***Fiber-Optic Cable (one required)*** | |
| Model 15-103 | 5 meter |
| Model 15-101 | 10 meter |
| Model 15-102 | 25 meter |
| Model 15-104 | 50 meter |
| Model 15-105 | 100 meter |
| Custom cable available in lengths up to 500 meters | |

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