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DATA SHEET

MODEL 477-1

Adapter with DMA connects a RISC System/6000 to a VMEbus system

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Bit 3's Model 477-1 Adaptor with DMA connects an IBM Micro Channel RISC System/6000 computer to a VMEbus system for fast, cost-effective sharing of memory and special purpose boards. The Model 477-1 Adaptor provides high-speed data transfers between the Micro Channel bus and VMEbus, and requires minimal software support.

The Model 477-1 Adaptor gives you the best of both worlds by uniting the power of VMEbus systems with the RISC System/6000 environment so that:

- Both systems can directly address resources at the remote end of the cable as though they were local.
- Random access reads and writes can be executed between systems.
- Blocks of data, I/O commands, and interrupts can be passed between systems.

Plus, the RISC System/6000 can function as either a coprocessor or as the only bus master processor in a remote VMEbus chassis.

With the Bit 3 Adaptor, each bus can operate independently. The timing of the two buses 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 the Adaptor cards is maintained by parity checks on address, control, and data lines.

Model 477-1 supports bi-directional A32/D32 random access cycles from either system and includes a built-in DMA controller. The DMA controller is a high-speed data mover engine that moves data between RISC System/6000 memory and the VMEbus at sustained transfer rates up to 26M bytes per second (M Bytes/sec). It also allows a VMEbus DMA device (such as a disk controller) to DMA through the Adaptor directly into RISC System/6000 memory at transfer rates in excess of 10M Bytes/sec.

Other Bit 3 Adaptors, supporting a wide variety of buses, can be used with Model 477-1 Adaptors to connect multiple computers and systems in star, daisy-chain or modified star/daisy-chain configurations.

COMMUNICATION BETWEEN SYSTEMS

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Model 477-1 supports two methods of intersystem communications: Memory Mapping and Direct Memory Access (DMA). Memory Mapping controls random access (PIO transfers) to VMEbus RAM, dual-port memory, and VMEbus I/O, and provides an easy-to-use, flexible interface with low overhead. A Micro Channel bus master can access memory in the VMEbus system through a window in Micro Channel address space. Conversely, a VMEbus bus master can access Micro Channel memory from a window in VMEbus address space.

Two Memory Mapping techniques are supported: Direct Mode (with address biasing) and Page Mode. Either technique may be used to control access to remote bus memory and dual-port memory. Access to remote bus I/O is not affected by the mapping mode.

Direct Mode has a one-to-one relationship between address windows. Data are transferred through one window directly into an equal size window on the other bus. Window size is configured via configuration jumper settings on the VMEbus Adaptor card.

In Page Mode, a window in the transmitting bus address space is coupled with a 16-bit programmable register. The address within the window provides the lower 16-20 address bits. The I/O register provides the upper 16-12 bits of the 32-bit receiving bus address.

Memory Mapping also controls access to dual-port memory. Bit 3's Dual Port RAM is an optional card that plugs into the VMEbus Adaptor card as a daughter card. Dual Port RAM provides a memory buffer, saves the cost of additional memory cards, and requires no additional VMEbus card slots. The following memory sizes are currently available: 32K, 128K, 1M, 2M, 4M, and 8M byte.

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 Adaptor arbitrates accesses.

DMA, the other method of communication, is the automatic transfer of data from one memory address to another. The Model 477-1 supports two DMA techniques: DMA Controller Mode and Slave Mode DMA.

DMA Controller Mode uses the Adaptor's DMA Controller to enable high-speed data transfers from one system's memory directly into the other system's memory without processor intervention. Data transfers can be initiated in either direction by the Micro Channel or VMEbus processor. Each DMA cycle supports transfer lengths from 4 bytes to 16M bytes. The DMA Controller also allows memory-to-memory transfers between Micro Channel memory and Dual Port RAM.

The Micro Channel Adaptor card uses Data Streaming to allow a burst data transfer rate of up to 40M Bytes/sec between the FIFO and the Micro Channel bus. This allows a sustained data transfer rate of up to 26M Bytes/sec between the RISC System/6000 and VMEbus Adaptor cards. DMA participants must be 16/32-bit devices.

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In Slave Mode DMA, the Adaptor card appears as a slave memory card. This type of DMA transfer is performed when a 32-bit VMEbus DMA device (such as a disk controller) transfers data through the Adaptor directly into RISC System/6000 memory. Support Software for Slave Mode DMA is in development.

INTERRUPT AND ERROR HANDLING

Model 477-1 supports interrupts from four sources:

- VMEbus interrupts (IRQ1 - IRQ7) can be passed by the Adaptor to the RISC System/6000.
- Programmed interrupts (PR and PT) can be passed in either direction.
- The Interface Error Interrupt can be activated when a timeout, parity error or bus error condition is detected on an Adaptor card.
- The DMA Done Interrupt is activated when the "Done Interrupt" enable bit is set and a DMA operation has ended. The interrupt remains active until cleared by forcing the "DMA Done" bit to zero or by starting another DMA operation.

An Adaptor card control register provides Micro Channel acknowledgment of VMEbus interrupts and vector passing.

VMEbus SYSTEM CONTROLLER CAPABILITY

In addition to VMEbus control and bus master capabilities, the Model 477-1 Adaptor can function as the VMEbus system controller. In System Controller Mode, the Model 477-1 Adaptor card provides bus arbitration, the VMEbus system clock and system reset, and the BERR global timeout. If the VMEbus system is to be used primarily as an expansion chassis, this feature saves the expense of an additional VMEbus system controller.

The VMEbus Adaptor card may be a Single-Level (SGL) bus arbiter or a four-level bus arbiter in Priority (PRI) or Round-Robin (RRS) Mode.

OTHER FEATURES

- Handshake Mode allows the Micro Channel processor to communicate with very slow VMEbus devices. When the Handshake Mode bit is set, software polls to complete the transfer.
- Separate A24 and A32 memory windows into the VMEbus from the Micro Channel bus.

TECHNICAL HIGHLIGHTS

- Random access reads and writes from the RISC System/6000 to VMEbus devices.
- Random access reads and writes from VMEbus masters to the RISC System/6000.
- Flexible mapping of RISC System/6000 address space to and from VMEbus memory and I/O address space.
- Direct Mode window sizes up to 256M bytes.

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- Page Mode allows access to 4G bytes of memory through page sizes from 64K to 1M byte.
- A32, A24 or A16 addressing, and D32, D16, and D8 data transfer mode support.
- Supports two Direct Memory Access (DMA) techniques: DMA Controller Mode and Slave Mode DMA.
- Supports Data Streaming on the RISC System/6000 to maximize throughput in DMA modes.
- DMA data transfers from chassis to chassis at sustained rates up to 26M Bytes/sec.
- VMEbus Adaptor cards can DMA directly into RISC System/6000 system memory at speeds in excess of 10M Bytes/sec.
- Add up to 8M bytes of shared memory via optional Dual Port RAM cards.
- DMA modes support Dual Port RAM.
- Interrupts can be exchanged between a VMEbus and a RISC System/6000 Micro Channel bus.
- Parity checking on address, control and data lines on the Micro Channel Adaptor card and on the interface between Adaptor cards.
- Round, EMI-shielded, copper-conductor cable to 25 feet. Cable is available in standard 8-foot and 25-foot lengths.
- Fiber-Optic Interfaces available as an option.
- Small profile Micro Channel Adaptor card (type 3) fits inside desktop RISC System/6000 systems.
- Supports all features of the earlier Model 477 Micro Channel Adaptor card.
- Power requirements: the VMEbus Adaptor card draws 2.6A at 5V; the Micro Channel Adaptor card draws 1.5A at 5V.
- Temperatures:

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Operating Temperature:     0 - 60 degrees C.
Storage Temperature:      -40 - 85 degrees C.
Humidity:                 0% - 90% non-condensing.
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- VMEbus Adaptor card meets IEEE 1014C specifications.
- Recognized under the component program of Underwriter Laboratories, Inc.

REQUIRED COMPONENTS

- One type-3 32-bit Micro Channel Adaptor card (included in Model 477-1 package).
- One 6U VMEbus Adaptor card (included in Model 477-1 package).
- A round, EMI-shielded, copper-conductor cable to connect the Adaptor cards (purchased separately from Bit 3).
- A device driver for the RISC System/6000 (optional Bit 3 Model 923 Support Software includes a loadable AIX device driver; software support for Slave Mode DMA is in development).

Each Model 477-1 package contains: one Micro Channel Adaptor card, one VMEbus Adaptor card and a manual. A cable is required but is ordered separately so that you can specify the appropriate length for your installation.

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OPTIONS

- 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
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- Cable (one required)

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8' Round EMI-Shielded              Model 400-107
25' Round EMI-Shielded             Model 400-108
```

Bulkhead connector configurations (contact Bit 3 for configurations)

- Fiber-Optic Interfaces

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Two Fiber Card               Model 400-5
Four Fiber Card              Model 400-6
Two Fiber Module             Model 400-50
Four Fiber Module            Model 400-60
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(Fiber-Optic Cards are for the VMEbus system only; Modules may be used with either the RISC System/6000 or VMEbus system. Two Fiber-Optic Interfaces are required. For more information, request the Model 400 Fiber-Optic Interface data sheet.)

- Support Software Model 923

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Pub. No. 100,212 9/95

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Revised: December 04, 1996

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