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DATA SHEET

MODEL 413-1

Adaptor with DMA for VMEbus to VMEbus connection

Share memory and special purpose boards between two VMEbus systems with Bit 3's easy-to-use, cost-effective Model 413-1 Adaptor. Model 413-1 provides high-speed data transfers between two VMEbus systems, and requires minimal software support.

The Model 413-1 Adaptor expands your computing environment by combining the power, memory and card capacity of two systems. Interconnected by the Adaptor, each system can:

- Directly address the other's resources as though they were local.
- Pass blocks of data, I/O commands, and interrupts to the other system.
- Execute random access reads and writes to the remote VMEbus.

Plus, the Model 413-1 can function as a coprocessor or as the only bus controller in the remote VMEbus chassis.

With the Bit 3 Adaptor, each bus operates 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 413-1 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 the VMEbus system memories at sustained data 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 VMEbus memory at data transfer rates in excess of 12M Bytes/sec. Actual performance rates are dependent on the capabilities of the specific VMEbus systems and speed of the VMEbus memories.

Other Bit 3 Adaptors, supporting a wide variety of buses, can be used with Model 413-1 Adaptors to connect multiple computers and systems in star, daisy-chain or modified star/daisy-chain configurations.

COMMUNICATION BETWEEN SYSTEMS

Model 413-1 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. Memory Mapping permits two processors to communicate via random-access memory reads and writes. The transmitting system can access up to 4G bytes of memory in the receiving system through a window in the transmitting system's bus address space.

Two Memory Mapping techniques are supported: Direct Mode (with address biasing) and Page Mode. Either technique can 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 jumper settings on the Adaptor cards.

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.

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The I/O register provides the upper 16-12 bits of the 32-bit receiving bus address. Thus, the transmitting system can scan 4G bytes of memory in the receiving system by paging through the receiving system's address space.

Memory Mapping also controls access to dual-port memory. Dual Port RAM is an optional card installed on either Adaptor card. Dual Port RAM 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 Adaptor arbitrates accesses.

Dual Port RAM cards now available from 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 413-1 Adaptor 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. Data transfer in either direction can be initiated by either system's processor. Each DMA cycle supports transfer lengths from 4 bytes to 16M bytes. The DMA controller also allows data transfers between VMEbus system memory and Dual Port RAM on the remote Adaptor card.

To initiate a DMA Controller Mode transfer, a processor sets the transmitting and receiving system's target addresses, and a word count. Bits in the command registers specify parameters such as, word width, destination address space (A16, A24 or A32), the address modifier, and Block or Non-Block transfer mode.

In Slave Mode DMA, the Adaptor 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 Adaptor directly into the other VMEbus.

INTERRUPT AND ERROR HANDLING

Any of the seven VMEbus interrupts may be passed to the remote system for handling by that system's processor. Programmed interrupts may be passed in either direction by writing to an I/O register on an Adaptor card.

There are four sources of interrupts from the Adaptor:

- Interrupts from the remote VMEbus backplane. Interrupt lines IRQ1 - IRQ7 may be passed from the remote VMEbus.
- Programmed interrupts from the remote card.
- An interface error interrupt that is activated when a timeout, parity error or bus error condition is detected on an Adaptor card.
- A DMA Done interrupt that is activated when the DMA Done 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.

VMEbus SYSTEM CONTROLLER CAPABILITY

In addition to VMEbus control and bus master capabilities, the Model 413-1 Adaptor can function as the VMEbus system controller. In System Controller Mode, the Model 413-1 Adaptor card provides bus arbitration, the VMEbus system clock and system reset, and the BERR global timeout. If the remote VMEbus system is to be used primarily as an expansion chassis for VMEbus cards, this feature saves the expense of an additional VMEbus system controller.

The VMEbus Adaptor 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.

TECHNICAL HIGHLIGHTS

- Random access reads and writes from system to system.
- Random access reads and writes from the VMEbus systems to Dual Port RAM.
- Flexible mapping of address space between the systems' memories and I/O address spaces.
- 32-, 16-, or 8-bit data transfers; A16, A32 or A24 addressing.
- Jumper settings map destination VMEbus "windows" into local VMEbus address space.
- DMA Controller Mode and Slave Mode DMA.

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- DMA modes support Dual Port RAM.
- DMA data transfers from chassis to chassis at sustained rates up to 26M Bytes/sec. Burst rates at 35M Bytes/sec.
- Page Mode allows access to 4G bytes of memory through page size from 64K to 1M byte.
- Add up to 8M bytes of shared memory via optional Dual Port RAM cards.
- Supports all features of the earlier Model 413 Adaptor.
- Interrupts can be exchanged between systems.
- Parity checking on address control and data lines and on the interface between Adaptor cards.
- Provides VMEbus system controller functionality with four level arbitration.
- Power requirements -

```
The VMEbus Adaptor cards draw 2.6A at 5V.
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- Environment -

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Temperature:            0 to 60 degrees C operating;

                        -40 to 85 degrees C storage.

Humidity:               0% to 90% non-condensing.
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- Round EMI-shielded copper-conductor cable to 25 feet. Cable is available in standard 8-foot and 25-foot lengths.
- Fiber-Optic Interfaces are available as an option.
- VMEbus Adaptor cards meet IEEE 1014C specifications.
- Recognized under the component program of Underwriter Laboratories, Inc.

REQUIRED COMPONENTS

- Two 6U VMEbus Adaptor cards (included in the Model 413-1 package).
- A round EMI-shielded copper-conductor cable to connect the Adaptor cards (purchased separately from Bit 3).

Each Model 413-1 package contains: two VMEbus Adaptor cards, and a manual. A cable is required but is ordered separately so that you can specify the appropriate length and type for your installation.

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
```

- Cable (one required)

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8' Round EMI-Shielded               Model 400-101

25' Round EMI-Shielded               Model 400-102
```

Bulkhead connector configurations (contact Bit 3 for configurations)

- Fiber-Optic Interfaces

```
Two Fiber Card               Model 400-5

Four Fiber Card               Model 400-6

Two Fiber Module               Model 400-50

Four Fiber Module               Model 400-60
```

(Fiber-Optic Cards or Modules may be used with either VMEbus system. Two Fiber-Optic Interfaces are required. For more information, request the Model 400 Fiber-Optic Interface data sheet.)

- Fiber-Optic Cable

High-quality, OFNP-grade, 62.3/125 micron glass duplex cable with tight buffer construction and ST-style connectors; standard cables are 5 meters (approximately 16') in length; custom lengths to 2 km are available.

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