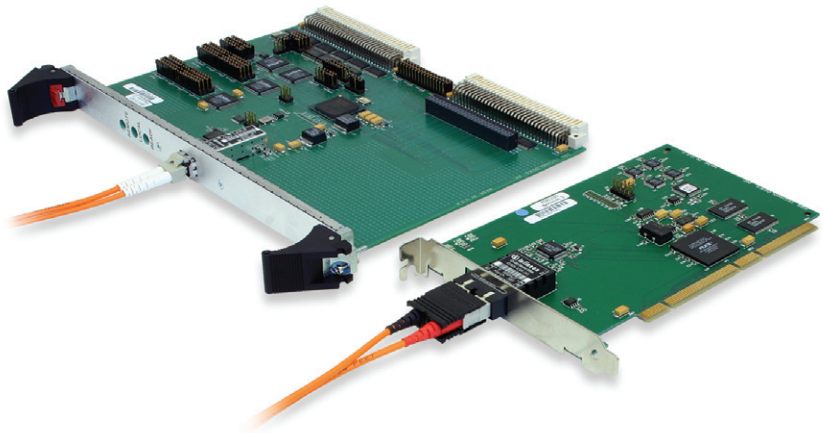
GE Fanuc
Embedded Systems



VME64 Bus Adapters

VME64 Bus-to-Bus Adapters with DMA

Features

- Streamlined no-protocol connectivity
- Memory and I/O mapping
- Bi-directional bus mastership
- Controller Mode DMA
  - 70 MB/s
- 2 ms latency
- VME System Controller Mode
- High-response hardware
- Bus isolation
- DMA modes support
  - Dual Port RAM
- 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
- Loopback diagnostics
- Data checking on the interface between cards
- 128 KB and 8 MB optional Dual Port RAM available for VME adapter card
- 192 KB Dual Port RAM on PCI card
- 64-bit PCI/CPCI/PMC
- Supports both 3.3 V and 5.0 V PCI bus signaling

GE Fanuc Embedded Systems' 8x0 VME64 bus-to-bus adapters are cost-effective solutions for applications requiring VME64 to VME64 or VME64 to PCI connectivity and fiber-optic capabilities. The bus adapters directly connect two buses. The virtual bus created allows the two systems to operate as one, enabling seamless operation, superior performance, and if the two buses are dissimilar, such as a PCI bus and a VME64 bus, the combined benefits of two diverse systems.

The adapter allows each bus to 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. Therefore, bus bandwidth is not affected during non-transfer periods.

Because the adapters do not require protocol stacks, they transfer data very efficiently. Remote data can be accessed directly by the processor as if it were stored in local hardware memory or it can be transferred to local memory using the DMA engine. Either way, the adapters are designed to transfer data with minimum processor loading. In fact, up to 16 MB can be transferred with only 8 register write commands from the processor.

A comprehensive suite of software drivers is provided for the PCI card to minimize integration time. In most cases, applications can be up and running in a few days. Drivers for Solaris™, IRIX™, Windows XP®/2000, NT, Embedded XP and Server 2003, VxWorks®, and Linux® are provided

What applications will benefit the most from VME64 bus adapter use? Applications requiring large amounts of data to be transferred very quickly and efficiently and applications demanding low latency access to remote data or devices. Applications with two memories that must be closely synchronized and applications that require VME64 and PCI, CompactPCI, or PMC to be integrated into one system will also benefit.

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VME64 Bus-to-Bus Adapters with DMA

Memory mapping

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; everything is handled by adapter and system hardware.

Bidirectional bus mastership in which address mapping is possible from both buses is provided by all VME64 bus adapters. GE Fanuc Embedded Systems 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 and any memory or I/O space address also can be memory mapped.

DMA controller

DMA (Direct Memory Access) 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.

Data can be contiguous or non-contiguous. Using the adapter's unique mapping RAM feature, data scatter/gather of up to 16 MB can be accomplished with a single DMA. No DMA chaining is required. The DMA address offset is done dynamically throughout the DMA transfer and can be unique for every 4 KB page of memory.

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. Data transfer in either direction can be initiated by the local or remote processor.

For VME64 to PCI adapters, the DMA controller allows transfers between PCI memory and Dual Port RAM on the VME64 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.

GE Fanuc Embedded Systems 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.

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 VME64 card requires servicing and eliminating the need to poll.

The adapters support two programmed interrupts that are used to communicate between host and remote processes.

Error interrupts from invalid accesses, cable disconnects, or other service disruptions can be generated.

In addition, a DMA operation can initiate an interrupt that can be sent to the initiating side of the adapter when the DMA is done.

VME system controller

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, thus providing system security and limiting bandwidth use to only the accessing bus. Memory mapping and both DMA modes support Dual Port RAM and arbitration is handled by the card itself. The PCI adapter card comes with 192 KB of Dual Port RAM

Programmed input/output (PIO)

A region of local memory can be transparently mapped by the adapter to memory space on the remote system. This is done transparently without any message or protocol stack required. The processor reads or writes the remote memory as if it were its own memory. The transaction takes only 2 ms, making the VME64 adapter ideal for deterministic, real-time applications.

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 VME address space
- I/O space on the remote bus
- Remote bus A24 memory located in the range 0x00000000 to 0x00FFFFFF
- Remote bus A32 memory located in the range 0x00000000 to 0xFFFFFFFF
- Local system memory accessed from the remote system
- Dual Port RAM on PCI card

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.

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 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.

Control and configuration

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

Easy integration

GE Fanuc Embedded Systems has made it easy to get the software up and running; the adapter can be integrated into an application within a few days. Instead of providing only a low level driver, we give the software engineer a simple-to-use application interface, the Mirror API. Mirror API lets applications share and access data with remote sources using simple, straightforward instructions such as open, close, bind, read and write. There are about 40 Mirror API commands.

Support software components

Compatible device drivers for:

Platform	Model	Operating System
Pentium Platforms	983	Windows NT
Silicon Graphics PCI Platforms	984	Windows 2000, XP, Embedded XP, Server 2003
Sun Platforms	946	Solaris
Intel-based PCI Platforms	993 1003	VxWorks 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

VME64 Bus-to-Bus Adapters with DMA

Specifications

Power Requirements
- VME64 adapter card draws 2.5A at 5V
- PCI adapter card draws 1.5A at 5V
- CompactPCI adapter card draws 1.5A at 5V
- PMC adapter card draws 1.5A at 5V

VME64 Adapter Card
- Meets IEEE 1014C specifications

PCI Adapter Card
- Conforms to PCI Local Bus Specification 2.2

CompactPCI Adapter Card
- Meets PICMG 2.0 R3.0

PMC Adapter Card
- Meets IEEE 1386.1 draft 2.0

VME64 to VME64 bus
- Accesses: A32
- Data accesses: 64-, 32-, 16-, or 8-bit

PCI bus to VME64 bus
- Accesses: A32, A24, or A16
- Data accesses: 64-, 32-, 16-, or 8-bit

VME64 bus to PCI bus
- Accesses: A32, A24 or A16
- Data accesses: 64-, 32-, 16-, or 8-bit

VME64 bus 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

Ordering Information

Model Number	Configuration
800	VME64 to VME64 adapter
810	VME64 to PCI adapter
820	VME64 to PMC adapter
830	VME64 to CompactPCI adapter
800-202	VME64 card only
810-201	PCI card only
820-203	PMC card only
830-204	CompactPCI card only

Dual Port RAM Options

400-202	128 KB
400-206	8 MB

Fiber-Optic Cable (one required)

Cable Number	For Model	Description
FCF-LC-05	800	5 meter multimode LC to LC duplex
FCF-LC-10	800	10 meter multimode LC to LC duplex
FCF-SC-LC-05	810, 820, 830	5 meter multimode SC to LC duplex
FCF-SC-LC-10	810, 820, 830	10 meter multimode SC to LC duplex

About GE Fanuc Embedded Systems

GE Fanuc Embedded Systems is a leading global provider of embedded computing solutions for a wide range of industries and applications. Our comprehensive product offering includes many types of I/O, single board computers, high performance signal processors, fully integrated, rugged systems including flat panel displays, plus high speed networking and communications products. The company is headquartered in the U.S. and has design, manufacturing and support offices throughout the world. Whether you're looking for one of our standard products or a fully custom solution, GE Fanuc Embedded Systems has the breadth, experience and 24/7 support to deliver what you need. For more information, visit www.gefanucembedded.com.

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Additional Resources

For more information, please visit the GE Fanuc Embedded Systems web site at:

www.gefanucembedded.com

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