The MIX Interface: A Mezzanine Bus for VME

- **'MIX'** is an acronym for Intel's **M**odular **I**nterface e**X**tension
- Uses 32-bit bus technology for VMEbus Systems
- Open, non-proprietary standard with development tools available
- Uses 130-pad surface mount stacking connector; up to 3 expansion modules in stack
- Provides CPU-independent interface
- Shortens design cycle for new-technology components
- Has addressing capability of 4 Gigabytes
- Data bus supports 16 and 32-bit transfers
- Supports memory and DMA transfers

Many proprietary interfaces for interconnecting boards and mezzanine expansion modules have been designed and are available from their manufacturers. The objective of these interfaces is to provide a private data and address path, so as to improve data transfer rates and avoid potential bottlenecks on the host bus.

This article discusses the MIX interface and presents its advantages when configuring high performance DSP systems on the VMEbus backplane.

MIX stands for **M**odular **I**nterface e**X**tension and was originally developed by Intel for high performance I/O modules in Multibus systems. Pentek has extended the concept to VMEbus systems as well. MIX is well defined as a non-proprietary open standard with powerful development tools available to shorten the design cycle. In addition, MIX allows you to configure systems with no cabling between baseboards and expansion modules.

What is it and Why use it?

The MIX bus is a high performance stacking and communications interface to connect expansion modules to a VMEbus baseboard. Pentek and other manufacturers adopted this bus because of its speed, reliability and flexibility.

This private bus allows not only for high-speed data transfers between modules, but also for extremely compact and reliable subsystem design. Up to three MIX expansion modules can be stacked on a VMEbus MIX baseboard with no cabling.

High-performance DSP systems based on the MIX bus greatly enhance the usable bandwidth of the host bus, because MIX provides a private high speed data and address path with interrupt lines dedicated to each expansion module. The MIX bus supports 32-bit data transfers and 4 GB of memory addressing capability, as well as DMA transfers.

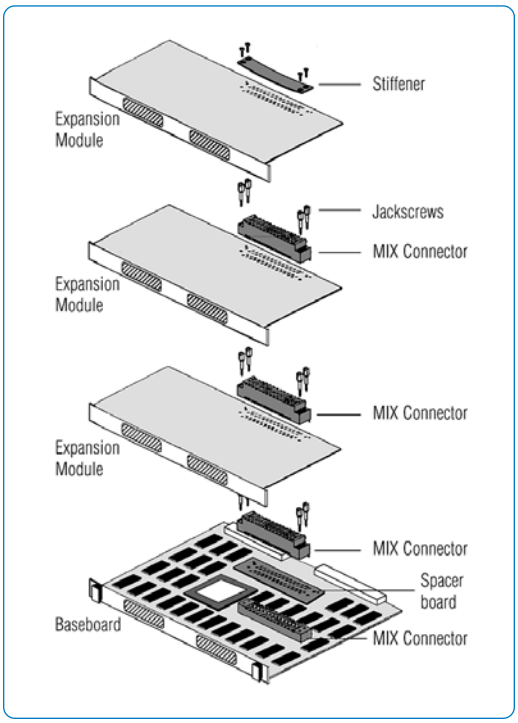

Figure 1. This MIX stack with a baseboard and three expansion modules occupies four card cage slots.

Pentek offers a variety of baseboards and expansion modules, so you can create powerful subsystems to fit your application. You can then reconfigure the same modular building blocks to satisfy new requirements.

Putting a System Together

Figure 1 shows the components and essential hardware needed to put together a full complement of a MIX stack. The MIX baseboard shown at the bottom of this figure is a standard 6U VMEbus board with two 96-pin male DIN connectors; they mate with the corresponding connectors on the VMEbus card cage backplane. The baseboard features a surface mount connector pattern which supports the MIX interface. This pattern consists of 130 gold-plated pads and holes for mounting the MIX baseboard connector, as shown.

Since all power and signal lines are provided through the MIX interface, there are no mechanical or electrical connections between the expansion modules and the VMEbus backplane. Each module has its own front panel which can be secured to the front mounting edge of the card cage with captive screws. The rear of the module is secured mechanically by the MIX connector.

Each MIX module incorporates the 130-pad MIX pattern on both top and bottom surfaces of its PC board, with data, address and control lines bussed between the two patterns. The surface-mount MIX connector which joins the modules has 130 mating gold-plated spring contact fingers on both top and bottom surfaces and provides a highly reliable electrical and mechanical connection. Manufactured by 3M Corporation, these board stacking connectors have passed extensive environmental and vibration tests.

Two different heights of this connector are used, a short one for the baseboard and a taller one for stacking the expansion modules.

Below the baseboard and on top of the last module in the stack, a stiffener bar is used to maintain uniform contact pressure between the MIX connector and the PC board. The stiffener is a slightly curved black steel spring strip with insulating polyester film on the surface which contacts the PC board. The stiffener is flattened against the board, so there is no interference with the VME boards in adjacent

card cage slots on either side. This is one of the most important advantages of the MIX system.

The only other special hardware used are the jackscrews on the MIX connectors: they pass through each stacking connector, the module's PC board, and into the threaded inserts of the MIX connector below. The top of each jackscrew has a threaded hole to secure the jackscrew of the next module in the stack, or the flathead screw used with the stiffener bar.

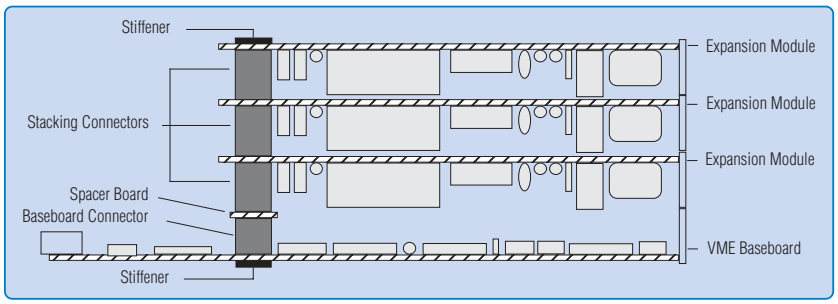

Figure 2. Side view of the MIX stack of Figure 1.

Depending on circuit complexity, the first MIX module may or may not require its own card cage slot. Figure 2 shows a side view of a completed assembly where the first MIX module must have its own slot. This assembly requires the use of a MIX spacer board in addition to the standard stacking connector.

In both cases, the second and third modules each require one additional card cage slot.

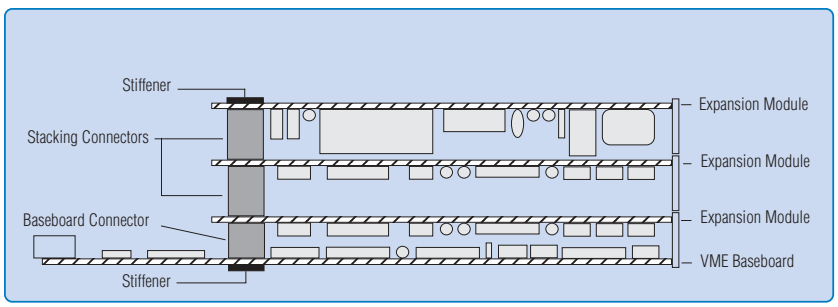

Figure 3. With the first module nesting, it's possible to stack three on a baseboard and still occupy only three card cage slots.

Some of Pentek's MIX modules are full-depth modules and extend to the P1 and P2 backplane connectors. Some of them connect to the VME backplane only to obtain power, while some others also offer a VME interface in addition to the MIX bus.

Figure 3 shows a side view of a completed assembly where the first module occupies the same slot as the baseboard. This "nesting" of the first module with the baseboard allows for single-slot baseboard/module combinations.

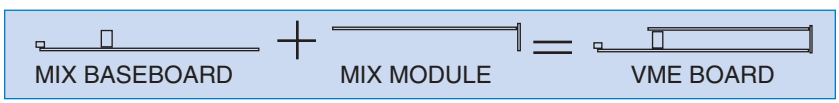

Figure 4. You can take any Pentek MIX module and change it to a VME board by combining it with a MIX Baseboard.

Converting MIX Modules into VMEbus Boards

For many applications it is desirable to convert a MIX expansion module into a standalone VMEbus board. Pentek offers a variety of MIX baseboards that allow you to perform the conversion shown in Figure 4.

For instance, the Model 4200A MIX Baseboard includes a powerful DMA controller for moving data between the VMEbus, the MIX bus and the VSBbus. A MIX expansion module stacked on the 4200A becomes a single-slot VME board and can thus gain bus master access to the VMEbus or the VSBbus. The MIX bus is also available to the VMEbus as a memory-mapped slave device.

The Crane Report

The Crane Division of the Naval Surface Warfare Center conducted environmental testing of the stackable MIX connectors used in Pentek baseboards and expansion modules. The purpose of this testing was to evaluate the response of the connector when exposed to various environments, and to characterize the connector electrically and mechanically before and after exposure to these environments. The tests were conducted on a MIX stack consisting of a Model 4200 MIX Baseboard and a Model 4249 A/D Converter.

Among other tests, the test plan included the following:

Test	Parameter
Dielectric Voltage	Mil-Std 1344, 350 VAC for 1 min
Insulation Resistance	Mil-Std 1344, 1000 M, 100 VDC
Contact Resistance	Mil-Std 1344, 100 mA max.
Humidity	Mil-Std 810, 10 days
High Temp. Storage	24 hrs at 125 ^{0}C
Low Temp. Storage	24 hrs at -55 ^{0}C

No problems were encountered as a result of these tests, and the Naval Surface Warfare Center recommended the use of the MIX connector manufactured by 3M in the Trident Submarine Navigation Center. ❑

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