

# An EPIC Tale: PC/104 Hitches On To PCI Express

PCI Express energizes EPIC Express, which is like PC/104 on steroids.

Express is apropos for the EPIC Express standard's name, because it puts PC/104 on the fast track to the next level. Efforts put forth by Ampro Computer, Micro/sys, Octagon Systems, Versalogic, and WinSystems resulted in the standard.

The main board format is the same size and general layout as the Embedded Platform for Industrial Computing (EPIC) standard. Its expansion modules are the same size as PC/104 modules. EPIC Express modules also incorporate the ISA (Industry Standard Architecture) bus and connectors used by PC/104 so PC/104 modules can be part of an EPIC Express solution.

EPIC Express has an elegant design. It retains the popular stacking architecture of PC/104 while providing access to new PCI Express-based modules as well as the plethora of existing PC/104 modules. The baseboard layout matches the PC/104 Consortium's EPIC standard for expansion and external connector layout. Therefore, an EPIC Express baseboard should fit into existing applications and case designs.

Modularity is a key feature of EPIC Express' design. The Standard Connector implementation supports four x1 PCI Express links that are significantly faster than the ISA bus and four times faster than the PCI alternative, PCI-104. The Standard connector occupies less than one-third the area of the larger PCI connector found on PC/104 Plus and PCI-104 boards.

This standard also defines a three-bank Full connector. The Full version includes the Standard connector bank interface plus two additional x4 PCI Express lanes. This brings more than 48 times the bandwidth versus PCI-104. A Standard Connector module can plug into a Full Connector module.

**A FULL STACK** • EPIC Express accomplishes its stacking goals by switching from a passthrough connector used for the ISA interface to surface-mount connectors from Samtec for the PCI Express interface. The connectors have a 15-mm mated, stacked height.

Every third pin is removed to enable optimal operation for high-speed differential signaling. A central ground connection offers better performance than using a signal pin. Each EPIC Express module uses one PCI Express link and shifts the remaining links (see the figure).

Links A through D are the x1 PCI Express connections, while E and F are the x4 PCI Express connections. An EPIC Express module typically will use only one link—either A or E, depending on the number of lanes required.

Maximum system size is one baseboard, two x4 modules, and four x1 modules stacked in that order. The average industry PC/104 stack size, including the baseboard, is 2.5 boards. Thus, EPIC Express should easily handle any configuration. There also can be any number of PC/104 modules stacked on top. The automatic alignment feature provided by the shifting of the signals allows the EPIC Express modules to be stacked in any order without resorting to configuration jumpers.

It's possible to use more than one link and still retain the automatic alignment feature by shifting more than one link. Alternatively, designers can use a PCI Express switch to provide access to more than one device on a module or to maintain the number of connections being passed to the upper board (see *EiED Online*, "Stacking PCI Express," *ED Online* 8666). I was amazed at how quickly the standard was developed and how comprehensive it was after discussing the topic with vendors involved in producing the standard.

**STACKING FOR THE FUTURE** • EPIC Express brings together the stacking architecture and the point-to-point architecture of PCI Express without sacrificing their flexibility. At least initially, the ISA interface will remain a critical component of the standard given the large number of PC/104 modules currently available.

In the future, systems may exclusively employ the PCI Express interfaces. But given the less than stellar success of PCI-104 and its lack of a PC/104 ISA interface, we should expect the ISA interface to remain very popular for years to come, even with EPIC Express.

Expect most of the initial baseboard designs to mirror the existing crop of EPIC boards. After that, all bets are off. A more compact baseboard, on the order of a standard module, will be very useful in compact applications.

EPIC Express baseboards and modules will start showing up around the end of the year.

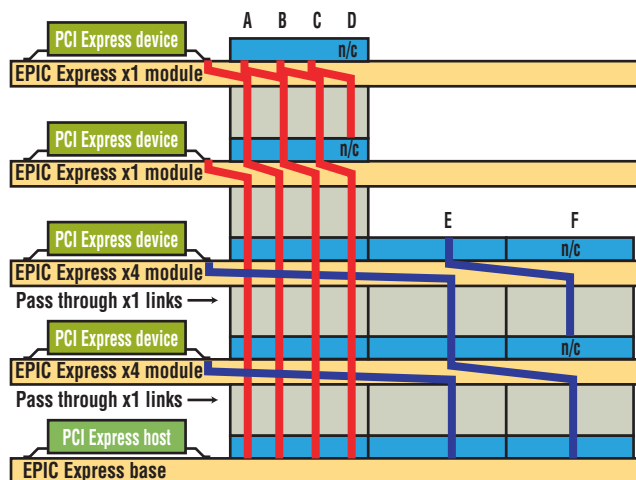
The timing is right, given the emergence of PCI Express-based microprocessors and peripherals. The standard is processor-agnostic, so look for non-x86 designs in addition to the traditional x86 PC/104 system designs.

The platform is well suited for applications that require high-performance interfaces, such as video processing, robot control, high-speed data acquisition, and sophisticated process control. For more details about EPIC Express, see Drill Deeper 10983 at [www.elecdesign.com](http://www.elecdesign.com).

**EPIC Express**

[www.epic-express.org](http://www.epic-express.org)

**ED Online 10939**



**The EPIC Express stacking architecture shifts the PCI Express links between levels in each module, providing a point-to-point link from the main board to a module.**