Introduction to PC/104 and PC/104-Plus

Using the PC and PC/AT architectures for both desktop and non-desktop applications is now well established, but using these architectures for embedded microcomputer applications was slow to take hold. The reason is that PC and PC/AT motherboards, as well as the accompanying expansion cards, are too large to be used with embedded applications.

This is where PC/104 comes in. The PC/104 architecture differs from the P996 standard in the following ways:

- Reduced form factor: 90 x 96 mm (3.543 x 3.779 in)
- Self-stacking bus that eliminates the need for backplanes or card cages
- Reduced bus drive power required for most signals (up to 4 mA), allowing fewer components and lower power consumption (typically just 1-2 watts per module)

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The ISA bus architecture has been a popular choice for embedded applications for a long time, and the publication of the PC/104 standard in 1992 made the ISA bus architecture available in a small, rugged form factor. Since that time, PC/104 has become an industry standard. As technological requirements advanced, a need arose for a higher bus throughput performance. This was especially true for graphics devices and other high-speed I/O devices such as networks. The PC/104 Consortium met this challenge by incorporating a PCI bus into the PC/104 form factor. This new standard has become known as PC/104-Plus. The architecture provides a link for versatile legacy hardware, and meets the high-speed requirements for both present and future hardware.

(This content is based on information from the PC/104 Org website.)

### Differences between PC/104, PC/104-Plus, and PCI-104

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The PC/104 standard specifies the mechanical and electrical specifications for a compact version of the ISA (PC and PC/AT) bus, but is optimized for the unique requirements of embedded systems applications. The specification referred to here as “PC/104” is based on the 104 signal contacts on the two bus connectors (64 pins on P1, plus 40 pins on P2).

**PC/104-Plus:**
To accommodate the gradual replacement of ISA bus devices with PCI devices, the PC/104-Plus standard was approved by the PC/104 Consortium. The PC/104-Plus connector supports both ISA and PCI buses to accommodate PCI devices in small form factor embedded computers.

**PCI-104:**
To accommodate the gradual replacement of ISA bus devices with PCI devices, the PCI-104 standard was approved by the PC/104 Consortium. PCI-104 is a PCI-only architecture that accommodates the advances of PCI devices in a small rugged form factor.
Industrial PCs were designed to work reliably in harsh industrial environments, and of all the features that distinguish industrial products from their commercial-grade cousins, the “wide temperature” feature is considered the most important.

The PC/104 embedded computer standard is defined by the PC/104 Consortium, which has specified both the form factor and characteristics of the computer bus. The standard was created specifically to meet the special conditions encountered by many embedded computing applications, which require reliable data transfer in harsh, industrial-type environments.

The PC/104 stack design is one of the most recognizable differences between the PC/104 standard and PCI standard, which is the most common standard used by PCs. Not requiring a backplane, and allowing the PC/104 boards to be stacked one on top of the other solves two major problems: several PC/104 expansion cards can be added easily to the same embedded motherboard, and the resulting structure is more stable, making it suitable for rugged environments. Stacking is achieved by using the mounting-holes in the corners of each module.

The PC/104 standard was developed for embedded applications, which require a smaller, more robust board. Since the main difference with standard expansion boards is size, designers can use existing software resources to reduce the time-to-market of their embedded applications.

Many industrial PCs now support a temperature range of -40 to 85°C, and Moxa’s PC/104 and PC/104-Plus modules also support an operating temperature range of -40 to 85°C, making Moxa a leading provider of hardware for embedded systems.

Support for Windows CE 5.0 and Windows XP Embedded
Moxa’s PC/104 and PC/104-Plus modules support a variety of operating systems that are used for industrial applications, including Windows CE 5.0 and Windows XP Embedded.

<table>
<thead>
<tr>
<th>Serial Interface</th>
<th>No. of Ports</th>
<th>Moxa’s PC/104 Models</th>
<th>Moxa’s PC/104-Plus Models</th>
</tr>
</thead>
<tbody>
<tr>
<td>RS-232</td>
<td>4</td>
<td>CA-104</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>CA-108</td>
<td>CB-108</td>
</tr>
<tr>
<td>RS-422/485</td>
<td>2</td>
<td>CA-132/132I</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>CA-134I</td>
<td>CB-134I</td>
</tr>
<tr>
<td>RS-232/422/485</td>
<td>4</td>
<td>CA-114</td>
<td>CB-114</td>
</tr>
</tbody>
</table>

Moxa’s PC/104 serial modules meet the embedded PC standard, and work with PC/104 CPU boards that accept the PC/104 expansion interface. Moxa’s PC/104 modules come with 2 to 8 serial ports, built-in 15 KV ESD protection, optional 2 KV optical isolation protection, and optional DB9 or DB25 connection cables to satisfy a variety of connection requirements.