J. Borges, Director of Marketing,
Control and Measurement,
SBS GreenSpring Modular I/O.

PC vs. PLC for Machine and Process Control

The proprietary architectures of traditional PLCs are prompting industrial system designers to explore alternative solutions. As an alternative, PCs offer standard hardware, software and GUIs -- but may lack in ruggedized specifications and high-level support. A middle ground is emerging to offer system designers the best of both worlds. This article explores the various paths to success in factory automation system design.

The challenges of machine and process control system designs have for many years been addressed through one of two traditional solution paths. One approach has been based on the installation of a programmable logic controller (PLC) from a leading vendor such as Allen-Bradley, Siemens, or General Electric. Such PLCs have typically been proprietary systems -- when you select a particular vendor and PLC family you are locked into the corresponding boards and functions that are available to that particular line. While this approach offers easy-to-integrate hardware, high quality components and knowledgeable support, it also is closed to unusual implementations or deviations from standard configurations. The options for programming the PLC have been limited to ladder logic traditionally and more recently cross-development from a PC. However, the systems are still generally based on PLC architecture that is cclosed - at least mechanical and electrically.

In cases where the industrial application is a stand-alone process -- controlling a painting head or a screw machine, for example -- the PLCs have served well as individual islands of manufacturing control. However, factory automation has evolved into complex, interconnected manufacturing cells. Process control data flows upwards from the cell into the MRP system, as dynamically reconfigurable process steps flow downwards. "Just in Time" JIT and an increasing number of offered products are the drivers towards reconfigurable manufacturing. Connecting the work cells into the plants MRP system requires new communication interfaces, and also creates a demand for statistical information and additional data acquisition at the work cell. Work cells are also increasing in sensor count and complexity. Often these newer sensors are difficult to interface with traditional PLC hardware. The communications interface, the statistical functions, the data acquisition functions, and the new sensors are often difficult to add to the traditional PLC.

Because of these challenges, the PLC is facing extinc-

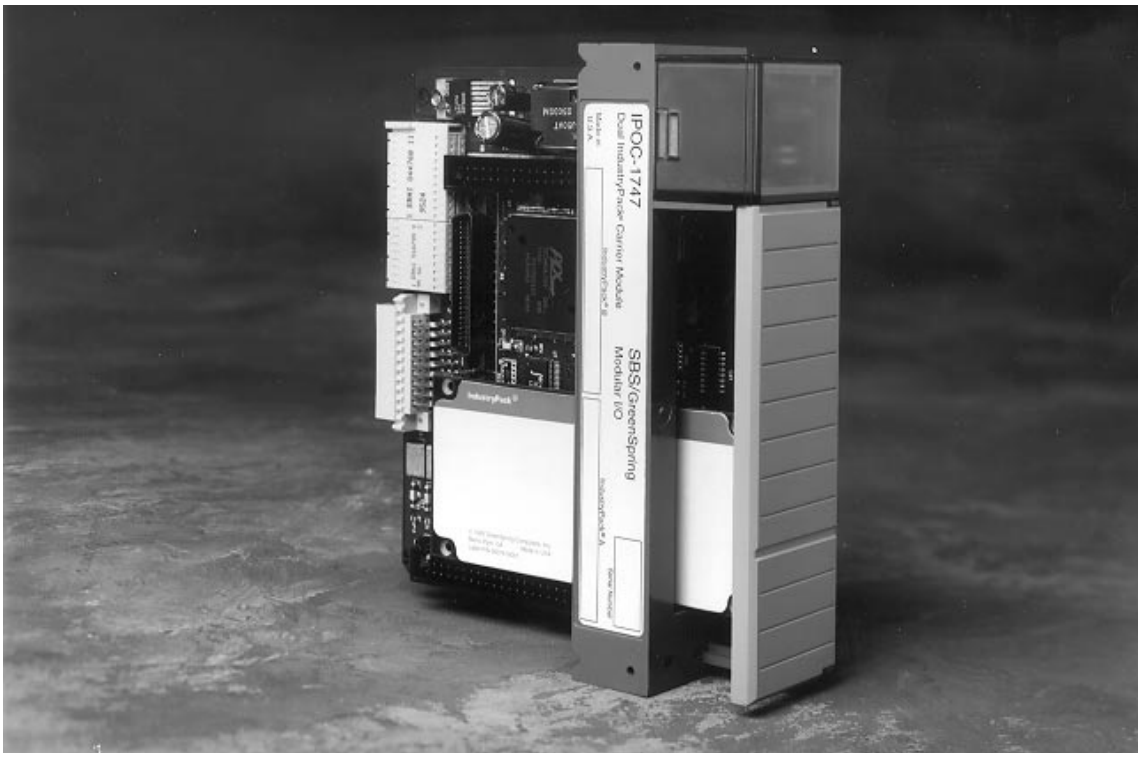

Figure 1. IPOC-1747

tion in some factory automation applications. Instead, system designers migrate toward a second solution path, PCs. This alternative offers the attraction of a standard development platform, available high-end application software, comfortable and standard programming languages and familiar graphical user interfaces. In industrial environments, however, PCs face reliability risks and expansion limitations. Adding a board can be difficult and the results unpredictable. PCs are not known for their deterministic real-time behavior.

The same PC hardware vendors and software development vendors that offer low prices are not prepared to offer the time of support-or product longevity-that the industrial user needs. Desktop hardware is not rated for wide temperature operating range nor rugged environments with vibration, shock and high temperature gradients. There are a number of middle-tier hardware vendors that are now offering standard PC architecture products, at reasonable prices, but with rugged specifications and support required for the factory environment. Still, standard, even ruggedized, PCs are no match for the mechanical simplicity and ease of hardware expansion that PLCs offer. DIN rail mountable hardware; fuses, LEDs, and screw terminal on every line; hot insert-these are a few of the standard PLC mechanical features not readily available on PCs. Consequentially, the advantages of flexibility in software and GUI familiarity are at the expense of the mechanical side and the rugged components.

The dilemmas posed by these two accepted paths for implementing factory control cells are significant, both posing major disadvantages along with benefits. As a result, there has been progress in developing a middle ground between the PLC and the PC, a combined solution that incorporates PCs into PLCs. In previous cases, the PC was added in, or bolted on, or an interface was added for cross-development to a PC. A third and more recent approach--demonstrated by the Allen-Bradley Open Controller family--is to actually base the PLC on a foundation PC. The Open Controller has a dual backplane, including a PCI bus along with the traditional PLC bus. While some aspects of the chassis are still proprietary, the most important aspects--the PCI bus and the standard operating systems are open to third party value-added. This allows configuration of all standard PCs boards, plus boards that are PCI based, running under a Windows NT application environment -- all sharing the same power supply and enclosure, with additional hardware added from both the Allen-Bradley sales and VAR channel, plus new vendors taking advantage of the open architecture and using their own sales and support channels. SBS GreenSpring, for example, offers the IPOC-1747 IndustryPack carrier which facilitates easy integration of their IndustryPack I/O modules with the Allen-Bradley 1747-OC Open Controller.

Another middle ground approach is to add soft PLC-style software to a PC in order to move it closer in functionality to the traditional PLC. Companies such as WonderWare have found success developing such software. This approach has been extended to the hardware side via manufacturers such as SBS GreenSpring with the IndustryPack PCI-40 boards, which facilitate easy-to-integrate, modular, flexible, I/O functionality. System designers can now obtain rugged PCs in a variety of configurations from vendors such as Teknor, Compaq and Hewlett-Packard, and combine them with the soft PLC and IndustryPack hardware for a full-featured PC based solution that is backed by sophisticated, industrial-level support. Most of the weaknesses of the PC channel are overcome in this manner, although integration of multiple vendors is still required.

The alternatives of obtaining a PC-based PLC from a leading vendor versus adding PLC software and hardware to a PC are both viable, and they are converging over time. Regardless of the chosen path, vendors such as SBS GreenSpring make I/O integration easy, with over a hundred standard IndustryPack modules and carrier boards for both platforms. IndustryPack modules can be plugged into the PC with Windows NT drivers and drivers for soft PLC packages; or an IndustryPack carrier board on an Allen-Bradley 1747-OC Open Controller backplane extend the bus to a diverse range of specially I/O from ANSI-VITA-4 compliant vendors.

J. Borges graduated from Boston College with a B.S. in accounting. He obtained his MBA from Harvard, and his B.S.E.E. From Northwestern Polytechnic University in Fremont, California. Borges was the Founder and President of Stryco Industries, a manufacturer of computer-controlled welding systems based in Livermore, California. He was the Vice President of Sales and Marketing for two Silicon Valley-based companies, ACI Computer and Racom Corporation, prior to joining SBS GreenSpring Modular I/O as the Director of Factory Automation.