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PLC, PAC or PC?

A look into PLC, PAC and PC-Based control for Industrial Applications

The advancement of computers has given way to a plethora of control devices in the automation world. From the tried and true Programmable Logic Controller (PLC) to the new PLC-PC hybrid Programmable Automation Controller (PAC) and the Smart and Open-ended PC-Based Control. The choices for automation control solutions are staggering. Many debates are still ongoing as to what direction the Automation Industry is headed, with some believing that it will eventually topple the rest of the competition. This leads me, and I'm sure others, scratching my head as I delve into the Automation Industry wondering what the best options are. That being said, the following is an overview of some solutions each approach offers, which will hopefully shed some light on the direction the Industry might be headed.



Image of the Productivity 3000 PAC

The first successful, commercially available minicomputer released in 1965 was the DEC PDP-8. Due to its smaller form factor and affordability, PDP-8 reached the hands of not just scientific laboratories, but businesses and factories as well. Soon to follow was the Programmable Logic Controller (PLC), conceived in 1968 to replace gigantic and complex relay panels used in the automotive industry. The first PLC was the Modicon 084 that could be programmed with a high level programming language where instructions were replaced with symbols on vertical bars attached by horizontal rungs reminiscent to Ladders, thus the name "Ladder Logic." Soon, the PLC moved its way to different production facilities outside of the automotive industry. Over time, the PLC has evolved with better CPU capabilities, more memory, sophisticated Ladder Logic capabilities and an array of different Digital and Analog I/O to accommodate customer needs. Now, analogous to Pareto's Principle 80/20, 80% of industrial control needs can be solved using a PLC; however, the other 20% require

complexities that push the boundaries of the PLC's capabilities. This push has led to the innovation of using PC-Based Controls as an alternative solution since PC in a form of industrial hardened embedded computers offers a wider variety of computational strengths that PLCs could not offer.

Controlling machinery through the use of PLCs is no longer all that is needed to increase productivity, quality, and revenue. Being able to gather key information throughout the factory, from alarms and status of the machines to temperature and humidity of the environment to the quality and throughput of the product; gathering, logging and analyzing this information can be crucial on the factory floor. These requirements can easily push the PLC to the edge, and the need for alternatives is apparent. Thus, the advent of the PAC and embedded computing supplies a feasible alternative.

The tag based software with complex mathematical capabilities, faster scan time, hardware auto-discovery and data logging of up to 64 different data values while supporting ODBC, SQL and other database formats allows a PAC like the Productivity 3000 to venture onto the factory floor with not just machine control in mind. The PAC sees this information as crucial, and being able to gather it for analysis is just as important as the machine it is controlling. Will it make the need for PC-Based controllers obsolete? Not quite. Data that needs to be gathered may not necessarily be at the grasp of one PAC or PLC based system. Data gathered throughout the floor needs to be routed to different data bases, and some of this data may not need to pass through the PLC or PAC first, but may still need to be analyzed before control changes are made.



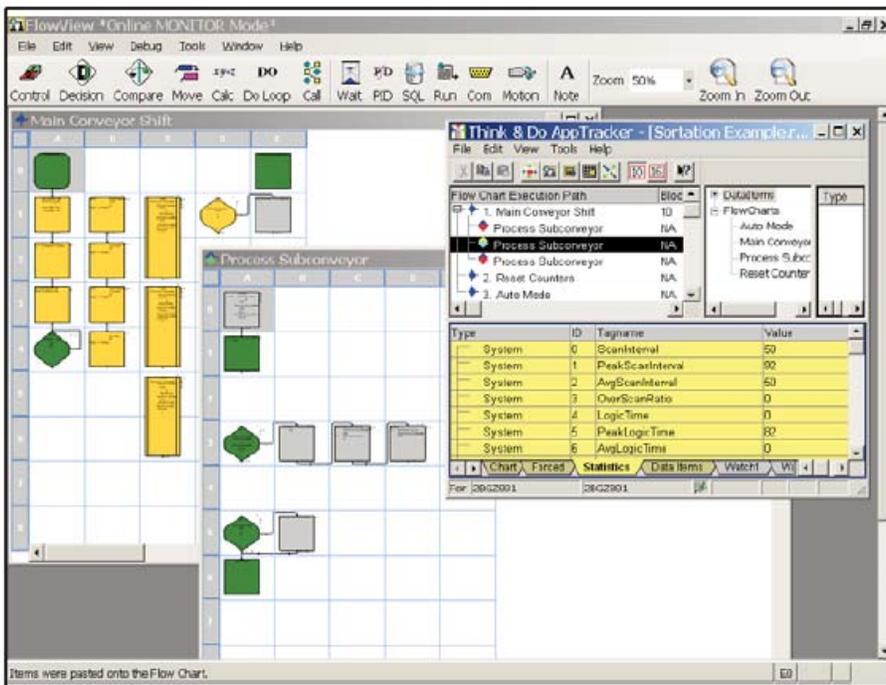
An Image of Advantech's 17" TPC-1770H with Intel 1GHz Celeron M Processor



An Image of Advantech's UNO-3072 with 2x PCI slot

For example, humidity and temperature changes can easily reduce the quality of products in a plastic molding factory. Having sensors throughout the factory to collect data may be required to determine adjustments needed on the "recipe" before production begins or as production occurs. This data may need to reach the controller first after analysis to decide on

what adjustments to make through the use of industrially hardened Touch Panel PCs like Advantech's TCP and IPPC product line. Also, data can be sent to a front end computer and to a central database system for trending



An Image of the Think and Do FlowView a Flow-Chart Logic software

and analysis as well before being distributed back to the factory control HMI for “recipe” changes. Furthermore, some inspection of complex devices like LCD screen auto-inspection systems may require the use of front end computers such as Advantech’s UNO embedded computer product line for quality inspection, stability analysis, and having devices like Productivity 3000 automate robotic arms coordinated with the vision system. The data gathered by these two machines, including alarms, defects, etc., is a lot easier to transport from the embedded computer to a remote server since protocol changes and databases are already provided by the front end computer.

PC-Based feel with a PLC look

PC-based controllers like the WinPLC by Host Communication provided with a Think and Do Studio or Think and Do Live allows the conversion of the PLC, Direct Logic 205 with proprietary Ladder Logic programming into a Windows CE PC-based controller that can run the PLC using Flowchart Logic, C++, C, Visual Basic and other languages that OEM’s or programmers may need to use on a particular application. This opens the door for a robust programming solution to compute and analyze data that may be hindered by ladder logic while still keeping the PLC form-factor and modules.



An Image of the WinPLC Module that can be used for the DL205 series to convert the PLC into PC-Based Controller

The Embedded Computers

PC-Based control and Embedded Computers are crucial as information gathered moves further away from the machine automation and into business systems and remote SCADA systems. Technicians and Engineers may not be the only personnel that want to see how the Automated System is doing. The



Image of Moxa's Wireless Embedded Computer W321

transfer of information through mediums like Cellular, Wireless, Ethernet Cable and Fiber Optic networks becomes a required system to consider when updating, retrofitting and creating industrial machinery and maintaining operation within the factory.

Smaller embedded computers like Moxa's UC-7112-LX-Plus with less computing power as a front end computer can find themselves within industrial applications as a back end computer. Even though the device has a computational power close to the PLC, Moxa's UC-71xx series still retains industrial hardened characteristics in a small form factor and provides a fully installed and ready to run Linux based OS or a Windows CE OS. Programming is robust; Python, C++, C, VB, Fortran, etc, a diverse array of program languages to choose from can be used to compute, analyze and manipulate data accumulated in the device to be transported to another computer for further analysis or a remote SCADA system through different protocols like the internet IPv4 and/or other internal network protocols that can be proprietary for the system. For example, the embedded computer can be used as a logger for an array of solar panels, string combiners, and inverters to analyze status of the inverter, efficiency of the solar panels, maintenance and power generation to be sent at a remote SCADA system using the Ethernet Port.



Image of MOXA's UC-7112 and UC-7110 Embedded Computers

With the increased need for information, the ability to connect smaller systems together and be able to monitor, optimize and maintain them without sacrificing reliable, long-term support of critical systems is crucial. This guarantees PCs, PACs and PLCs a position on all factory floors, especially due to the ability of each to evolve with the market and provide control systems with an array of solid solutions catering to the needs of just about any application.

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Other Sites:

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