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**BECKHOFF** New Automation Technology
Technology 2010

In 2009, technology was good to us. I can’t complain. Technological advances made digital jobs more fun and interactive, and applying these technologies to Machine Builder Nation turned out to be a fun ride.

At the beginning of this year, we went through a digital makeover. Our cyber home, ControlDesign.com, unveiled a stylish welcoming page, making it easier and more intuitive for our visitors to access the latest articles, multimedia files, white papers and news stories. Our new and improved home screen captures our visitors’ attention with attractive images and headlines.

If you want to read more on our redesign, check “Website Gets a Face-Lift” at www.ControlDesign.com/face-lift.

Not only did we get a facelift, but we integrated social media outlets that allow us to reach a younger machine-nation audience and keep up with our techno-savvy loyal readership.

Our first technological interactive approach was our Machine Builder Forum (MBF). Here, we post questions, comments, concerns, news and even some entertaining industry-related news. This past year, we discussed vision systems, industrial integration approaches and machine safety issues, among other subjects, on MBF. To follow up on our previous conversations or to start a new one, log on to www.ControlDesign.com/mbf.

2009 was the year for our editors to become viral movie stars. Our video library grew in video numbers with the production of our 2009 video releases, such as Machine Builder Spotlight videos and Market Intelligence Report videos. I even had the opportunity to work on-set and behind-the-scenes on many of our “webisodes,” and in a few opportunities I landed the leading role.

Check our 2009 videos by visiting www.ControlDesign.com/multimedia. You can also catch these videos on our YouTube Automation channel. Log on to www.youtube.com/controldesign and watch us in action.

The technological release I enjoyed the most this year was the minute-by-minute news update, or what most of you know today as “tweets.” Control Design made its mark on Twitter and kept its machine-builder tweeters up to date. Do you want to join the flock? Follow us at www.twitter.com/control_design.

If you are more of a Facebook fan, don’t worry. You can find us there, too.Become a ControlDesign fan at www.facebook.com/pages/ControlDesign-BuilderNation turned out to be a fun ride.

Now, with these technological advances, I can only wonder how technology will affect us in 2010. Maybe you will catch us on the Google Wave, as the latest iPhone app or as another application on the Droid. All I can suggest is to stay tuned to ControlDesign.com. We will keep you current with technology changes that affect this industry. See you next year to learn where 2010 will take us. If
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**ON CONTROLDESIGN.COM**

you’ll find two articles relating to machine automation from our coverage of this year’s Rockwell Automation Fair held in Anaheim, Calif., last month at ControlDesign.com/performance and ControlDesign.com/sustainability.

These comments and observations of machine users and builders who participated in a couple of panel discussions and presentations are a good read.

Here are a few excerpts from the six machine builders and one automation user about machine performance and total cost to design, develop and deliver machines.

Andy Pringle is engineering director at PCMC, which builds machines for the converting industry. He said that deciding on the automation for a machine sometimes requires a conscious effort to avoid the Magpie Effect of replacing a shiny, new component that appears to save a few overall dollars at the bill-of-material level, but means adding a new $1,500 part to needlessly have to support.

Pearson Packaging Systems, like PCMC, builds to order with virtually no inventory, despite being in what President and CEO Mike Senske calls a low-volume, high-variability business. His company surveyed 300 old, new and potential customers to distill down the key needs and translate them into the actions that fulfilled their need for shorter lead times. “That was the No. 1 request,” said Senske. “They also identified unanticipated downtime as a key factor, so they wanted our choices of components and subassemblies to be accurate and dependable.” Pricing actually came fourth on the list. “That’s from the technical folks’ perspective,” he said. “Price is an entirely different conversation with some purchasing folks.”

The other link is to a discussion about several companies’ sustainability initiatives and some sobering data about the daunting task ahead if Congress legislates the carbon-reduction requirements currently in the pending Waxman-Markey bill. It includes reduction of global warming gases by 83% of 2005 levels by 2050.

**Deciding on automation sometimes requires a conscious effort to avoid the Magpie Effect.**

Even if we eliminated all fossil-fuel-based electricity generation and all fossil-fuel-consuming vehicles, Chan says that still wouldn’t address the enormous energy consumption of steelmaking, cement manufacturing and other heavy industrial segments, with enormous legacy equipment bases that can’t be turned quickly. “We’ll need to replace steel,” he stated. “We have to drive the next industrial revolution.”

Joe Feeley
Wireless Sensors Depend on Needs

LET’S SAY YOUR machine is really a system consisting of multiple modules. The main module contains most of the I/O, all hardwired, but wiring to separate and smaller modules is limited and always has been a pain.

A wireless solution could be the answer.

On the other hand, maybe your machine is huge, with most of the wiring concentrated in one area, but there also are a few areas far from the central nexus of control where you need to sense and monitor certain operating parameters such as presence, temperature or vibration.

A wireless approach could save wiring time and expense in such a case.

Another application where wireless works well is a case in which it’s impractical to hardwire a sensor. You might wish to monitor vibration on a motor shaft, but realize it’s impossible to hardwire a sensor because of the rotation.

In these instances, there are two main ways to apply wireless monitoring and control. The first is with single-channel wireless, the only option for the rotating-shaft application. The second is via wireless multi-channel I/O nodes.

Let’s look at each option.

You might wish to monitor vibration on a motor shaft but realize it’s impossible to hardwire a sensor because of the rotation.

With the single-channel option, each wireless sensing device communicates directly to a centralized wireless gateway via its own radio. The gateway normally is located nearby and hardwired to the main controller. The gateway communicates with each wireless sensor individually, either one-way or bidirectionally.

The wireless communication radio can be built directly into the sensor or, more commonly, supplied via a separate, wireless, single-channel radio. “The cost to put radios on today’s discrete sensors is prohibitively high,” notes Cliff Whitehead, manager of strategic applications at Rockwell Automation (www.rockwellautomation.com). “Few discrete sensing applications could tolerate the price increase required to wirelessly enable the sensor, instead of wiring it to a separate radio.”

As there are few sensors available with built-in radios, most single-channel applications will use a radio hardwired to the sensor, with the radio communicating wirelessly to the gateway.

The main issue here is providing power to the sensor and to the radio. If the power is supplied via wires rather than batteries, then the advantages of wireless are greatly reduced. Fortunately, many battery-powered, single-channel radios can supply power to a sensor for years before a new battery is needed.

A much more widely used and much more practical approach is a wireless multi-channel I/O node. This approach works very well when the application calls for a number of sensors remote from the main machine controller. Rather than wiring each sensor back to the main controller individually, the sensors instead are hardwired to the local I/O node with both power and control connections.

“To enable the monitoring and control of a typical machine, we offer a simple wireless I/O node,” says Bob Gardner, wireless product manager at Banner Engineering (www.bannerengineering.com). “The wireless I/O node provides six digital inputs and six digital outputs. The node is monitored and controlled wirelessly from a remote wireless-to-Modbus gateway. The gateway is hardwired to the PLC or HMI via a Modbus serial interface.”

In addition to the digital node, Banner offers units with analog I/O for sensing parameters such as temperature, vibration and humidity. “Our battery-powered I/O nodes are popular because they need no power wiring and can operate for one to five years on a single battery,” adds Gardner.

The wide disparity in battery life quoted by Gardner hints at one of the main application issues with wireless multi-channel I/O nodes, namely power management.

For a simple system with low-power sensors and just a few discrete I/O points, a battery-powered node could be the right solution. But when the number of sensors required increases or when the sensors require more power, it might be best to supply power to the I/O node via hardwiring, as the alternative will be frequent battery changes.
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<table>
<thead>
<tr>
<th>Level limit switch for bulk solids</th>
<th>Vibration limit switch for bulk solids</th>
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<tbody>
<tr>
<td><strong>Minicap</strong> FTC260/262</td>
<td><strong>Soliphant T</strong> FTM20</td>
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<tr>
<td>- Calibration–free start-up</td>
<td>- No calibration, easy start-up</td>
</tr>
<tr>
<td>- Active build–up compensation</td>
<td>- No moving parts</td>
</tr>
<tr>
<td>- Maintenance free, rugged design</td>
<td>- Sensor material 316L</td>
</tr>
<tr>
<td>Starting at $240 (for 1-5 pcs.)</td>
<td>Starting at $464 (for 1-5 pcs.)</td>
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<tr>
<th>Level limit switch for solids</th>
<th>Vibration limit switch for liquids</th>
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<tbody>
<tr>
<td><strong>Nivector</strong> FTC968</td>
<td><strong>Liquipoint T</strong> FTW31/32</td>
</tr>
<tr>
<td>- Maintenance-free operation</td>
<td>- Detect up to five level limits</td>
</tr>
<tr>
<td>- No calibration, quick start-up</td>
<td>- No moving parts in the tank</td>
</tr>
<tr>
<td>- With “Protector”: no contact</td>
<td>- No calibration required</td>
</tr>
<tr>
<td>with solids</td>
<td></td>
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<tr>
<td>Starting at $160 (for 1-5 pcs.)</td>
<td>Starting at $138 (for 1-5 pcs.)</td>
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<thead>
<tr>
<th>Multiple point liquid level limit switch</th>
<th>Capacitance level limit switch for solids</th>
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<tbody>
<tr>
<td><strong>Liquipoint T</strong> FTCW31/32</td>
<td><strong>Liquiphant T</strong> FTC260/262</td>
</tr>
<tr>
<td>- Detect up to five level limits</td>
<td>- Reliable tuning fork technology</td>
</tr>
<tr>
<td>- No moving parts in the tank</td>
<td>- Compact size</td>
</tr>
<tr>
<td>- No calibration required</td>
<td>- Rugged stainless steel housing</td>
</tr>
<tr>
<td>Starting at $138 (for 1-5 pcs.)</td>
<td>Starting at $240 (for 1-5 pcs.)</td>
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</table>
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- Pressure transmitters for sanitary use
  - Flush-mounted process connections
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Application example
- Measurement System
  - PMC131 - Pressure Transducer
  - RNS221 - External power supply
  - RIA261-C2K - Display
- Local display
- Power supply
- Analog output 4 to 20 mA to PLC or Recorder

Capacitance continuous level measurement for liquids

Safe pressure switch to 6,000 psi

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Application example

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2. Liquiphant T FTL20 measuring high level condition
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**Ecograph T**

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- Web server function allows for remote monitoring from anywhere via the web
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### Application example

[Application diagram showing RIA250 local display and loop-power supply, a sensor for pressure measurement, an Analog output, a PLC, and a Recorder Example: Ecograph T from E-direct.]
Active IS barrier

RN221N
- Loop power supply and IS barrier in one device
- Communication sockets for HART®
- With FM AIS intrinsically safe input

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DIN Rail signal conditioner

RMA421
- Most standard measurement signals (V, mV, mA, RTD, TC, Ω)
- Flexible set point monitor with 2 relay contacts and scalable output
- Built-in linearization function

Starting at $346 (for 1-5 pcs.)

Limit alarm

RTA421
- 2 relays for set point monitoring (with changeover contacts)
- Loop power supply (option)
- Quick setup

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Power supply

RNS221
- Two-channel supply for two 2-wire sensors or transmitters
- LED status indicators
- Wide range power supply: 20 to 250 V AC/DC, 50/60 Hz

Starting at $192 (for 1-5 pcs.)

Application example

Connect to an Endress+Hauser RMA421 to supply loop power, provide local display, and retransmit signal to a higher level controller. For power supply only, use Endress+Hauser RNS221.
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U.S. OEM Designs Machines That Can Be Integrated With Equipment From Around the World

IN 1984, THE founders of P&L Specialties (www.pnlspecialties.com), a manufacturer of customized machinery in Santa Rosa, Calif., were determined to produce only the finest quality equipment. “This unwavering commitment has remained the cornerstone of our operating principles,” says Ed Barr, president. “It has been possible only by employing the finest craftsmen and artisans.”

Almost all of P&L’s machines are built for the wine and food industry. They include sorting tables, bin dumpers, receiving hoppers, catwalks, belt and screw conveyors, rotary screens, mixers and other specialized food equipment.

P&L’s equipment is designed to integrate seamlessly with product lines from CME, Demoisy and Sutter.

“We import the best in pumps and destemmers from CME in Italy,” says Barr. P&L is the exclusive North American representative for Demoisy winery equipment, and also offers Swiss-made Sutter pneumatic presses, says Barr.

With 30 employees at its California facility, P&L primarily builds belted conveyors. “They are stainless-steel-framed units with roller-bed design,” explains Barr. “They are outfitted with a motorized drum pulley that we have been using for many years. We also build our patented LT MOG separation machine. It is an oscillating drive-powered machine that removes undesirable material from the grape processing stream.”

Barr’s father is a registered civil engineer who is on staff to check on the structural integrity of catwalk and support structures that P&L builds. “The production manager and I are licensed airframe and power plant mechanics,” says Barr.

“And the vice president/founder is a German-trained machinist. We have a very diverse employee base with a real understanding of mechanical systems, built-in redundancy and safe design.”

P&L stocks spare parts, including old design parts or retrofit kits in the case of obsolete stock, explains Barr. “Frankly, technology creates levels of obsolete parts as we migrate from one product to the next,” he explains. “We try very hard to keep the same control parts on our equipment for the longest amount of time to reduce the confusion and stocking requirements. If we find a good reliable part, we will use it as long as we can. Price is not the issue. It’s about reliability and support from the manufacturer.”

P&L Specialties uses basic VFD controls with programmable parameters, explains Barr. “Occasionally, we will use relay logic to control systems, and rarely we will use a PLC to control items,” he says. “Our controls are preprogrammed VFDs with adjustable parameters and PLCs. Everything is hardwired.”

Innovations in P&L’s machines are driven by customers’ desires to involve less manpower in their operations and to improve the product quality, which requires increased adjustability and functionality of the machinery, explains Barr.

MORE MOG
AS SUPPLY-CHAIN management casts an eye toward demand visibility and production performance, the inevitable collisions between IT personnel and manufacturing network engineers become more pronounced. But two companies, Coca-Cola and Procter & Gamble (P&G), are turning those clashes and conflicts into convergence and cooperation.

Jeff Kent, technology section head, controls and information, at P&G (www.pg.com), and David Bynum, principal engineer from Coca-Cola North America (www.coca-cola.com), explained this past November at Rockwell Automation Fair in Anaheim, Calif., how their enormous companies have straddled the chasm and begun to tap valuable manufacturing data.

“In our internal culture, when the IT department wants data, they come and get it,” explained Kent. “We know how damaging that can be. In these very integrated, high-effort systems, we need to reduce the effort.”

One key hurdle at P&G is having OPC as a way to connect to the control platform. “There were interventions made, and we backed them off the polling rates or number of tags, or we’ve explored other ways to mirror the data so they can access that chassis, rather than our real running controller,” said Kent. “Making Logix a data server actually means creating mirrored data, so we don’t constantly hit the controller with OPC calls.”

At Coca-Cola, it’s all about being in tune with a demand-driven supply chain and striking the right balance between efficiency, service and cost. To ERP has given us some momentum. We don’t allow IT to just come and take whatever information they want. Creating an information layer reduces latency on the actual controller and HMI at the shop-floor level.”

Based on what these large users are doing, I asked some system integrators and users what they are seeing.

James Ingraham, software development team leader at Sage Automation (www.sagerobot.com), Beaumont, Texas, says most of the system integrator’s customers, although not the size of Coca-Cola or P&G, haven’t been integrating machinery with the IT network. “The coupling point still seems to be barcodes on products or pallets as they come off the production line,” he says. “Even when there are nice windows into the production environment, individual machines usually aren’t part of that. We rarely even get assigned IP addresses for our Ethernet equipment. We have seen a few sophisticated systems, where IT has been involved and specified gateways and segregated networks and handed out IP addresses, even allowing remote VPN access.” But, Ingraham says, it’s the exception, rather than the rule.

“Our IT department is highly involved in projects concerning control and control systems,” explains Choy-Hsien Lin, development engineer, process control, at Stora Enso Publication Paper (www.storaenso.com), a global paper manufacturer in Hyltebruk, Sweden. “There is a growing need for Ethernet communication and other high-level protocols. This increases the number of attack vectors to the systems, exposing them to significant security risks. Data from our plants are aggregated in several central systems, but the ERP is connected only to specific points where custody transfer occurs.”

Production data isn’t typically collected by ERP systems, explains Stuart McFarlane, vice president, Viewpoint Systems (www.viewpointusa.com), Rochester, N.Y. “This still sounds like a good idea, but it’s very difficult to implement and manage,” he says. “IT and plant engineers do not typically play nicely together. The most successful companies’ IT organizations realize they are there to support the business in the most effective and secure way possible, and are part of the solution and not part of the problem.”

Siblings Can Learn to Play Nicely

Mike Bacidore  managing editor  mbacidore@putman.net
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China No. 1 Machine Builder by 2011

CHINA WILL BECOME the world’s leading producer of industrial machinery by 2011, according to the latest machinery production statistics from IMS Research (www.imsresearch.com). Within two years, the country will have moved from fourth in the world to first, overtaking Japan, Germany and the U.S. This rapid transition is fueled both by exports and the country’s own increasing domestic demand, according to IMS.

China, like most other countries, has been affected by the global recession, and the rate at which its production of machinery is growing dipped steeply in 2009. However, its preceding strength means that, despite the credit crunch and the effects on its exports, China’s machinery industry is forecasted to show continued growth in 2009. According to IMS Research’s latest figures, it is predicted that machinery production in China this year will be higher than in 2008 by 3.9%.

“One reason for China’s superior performance compared with its closest rivals is that the likes of Germany and Japan rely so heavily on exporting their products,” explained Andrew Robertson, analyst at IMS. “Since the credit crunch has caused a huge drop in exports, these countries have particularly suffered. Although China’s machinery industry does export vast amounts, it can also rely on its increasing domestic demand to prop up the industry in these difficult times.”

Credit Index Breaks Into Expansion Territory

THE CREDIT MANAGERS’ Index (CMI), a monthly survey of credit professionals’ business cycles, has broken past the neutral 50 barrier for the first time in more than a year, reported the National Assn. of Credit Management (NACM) in Columbia, Md. The index started in that direction in September, when the service side of the equation improved to 50.1, but manufacturing still lagged, finishing at 49.6. Now both sectors are showing expansion, and the CMI as a whole is pointing toward growth.

Dr. Chris Kuehl, economic analyst at the NACM (www.nacm.org) identified two streams of good news. “Not only has there been some expansion in credit availability, but there continues to be evidence that companies are catching up on their debt,” said Kuehl. “Companies that had been behind in their obligations are catching up in anticipation of further growth and the need to ask for more credit in the future. By the same token, there is more money starting to filter into the system, making credit more accessible than it has been in some time.”

The manufacturing sector finally crested the 50 mark in October, a long-awaited development and one that is consistent with other economic data coming from the industrial community as a whole. “After falling just short of the growth mark in September at 49.6, manufacturing numbers are now past the neutral zone and are standing at 51.2,” said Kuehl. “This is a pretty sharp gain given the slow development over the past several months. While it took from July to September to move 1.3 points, it only took one month for the sector to move 1.6 points to reach October’s numbers. This is rapid expansion by any measure.”
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NOTEWORTHY

Optimation (www.optimation.us) has been recognized by Eastman Kodak (www.kodak.com) as a Kodak Certified Supplier.

Flir Systems (www.flir.com) delivered its 100,000th commercial-use infrared thermal-imaging camera.

MERGERS, ALLIANCES & ACQUISITIONS

Intelligrated (www.intelligrated.com), a material handling machine builder, received $24 million in financial incentives from the state of Ohio to accelerate the company’s acquisition of FKI Logistex and expand three facilities in Ohio.

Schneider Electric (www.us.schneider-electric.com) will update machine controller and I/O system ranges in the next step of its technology partnership with B&R Industrial Automation (www.br-automation.com).

Rockwell Automation (www.rockwellautomation.com) and Eplan Software & Services (www.eplanusa.com) collaborated on improving controls data exchange.

FSI Technologies (www.fsinet.com) and Eye Vision Technology (www.evt-web.com) joined together to bring EyeSpector Smart Cameras and EyeVision machine vision software to North America.

MAG Industrial Automation Systems (www.mag-ias.com) and Dowding Machining (www.dowdingmachining.com) collaborated to bring machine automation to wind-turbine blade fabrication.

PLUG FEST COMES TO NORTH AMERICA

At the first North American EtherCat Plug Fest in Austin, Texas, four new master implementations were tested with slave devices from eight different vendors. The goal of the event, hosted by National Instruments (www.ni.com), whose president, CEO and cofounder, Dr. James Truchard, gave the opening speech, was to check the interoperability of EtherCat implementations. The EtherCat Technology Group (www.ethercat.org) is attempting to improve worldwide support and interoperability of EtherCat devices through the Plug Fest events that have been held in North America, Asia and Europe.

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Noticeable Absences

THE FINAL ISA EXPO in the current format has come and gone. Houston is such a great time. I don’t get to “nerd around” that often with people of such global influence. The perspective is inspiring.

That was the word I was looking for during a conversation with some vendor reps on the show floor. The discussions centered around the lack of interest in the ISA show by automation professionals. It had become regional in its nature. There was no buzz and, of course, no real sign of innovation.

It was all about wireless, network switches and big valves. Where did all the technology go?

Some of the most noticeable visitors to the show were people and companies looking for new profit paths from companies that were looking for representation. Distributors and agents were plentiful, as one booth guard mentioned.

Wow, what a difference five years makes.

So where did everyone go? It seems that there are many answers.

A keynote address at the ISA conference was about the “maintenance crisis.” The average age of people in the process and automation industries is 48. The gray-hair component is far too heavy, and it will continue to get worse.

The Canadian government in its infinite wisdom lowered tariffs on imported machinery. This means that a competing machine builder in Europe has a better chance of selling his technology into Canada than a Canadian machine builder does. While this does not mean that a Canadian vendor is hopelessly less competitive than an offshore vendor, I question the actions of some governments in general when it comes to a lack of encouragement for local manufacturing.

And then a conversation fired up about unemployment and how it seemed that everybody knew someone who had lost a job of “x-many” years. Yes, it is tough, but, if you believe numbers from ARC Advisory Group, revenue for discrete automation systems is to grow to $21 billion by 2012. Looks like a growing business to get into. But I guess you first have to convince a lot of people that they are right.

When he spoke at the Control System Integrators Assn. conference, Alan Beaulieu of the Institute for Trend Research called the recession, just as most economists didn’t. So when Alan speaks, does everyone listen? Maybe. But he does think that we are not at the bottom of the cycle yet and we have some time to go.

One of the issues he talked about was the “paint everything with the same brush” mistake. That means you need to treat your top customers as top customers. Treat your top performers as top performers. Train them. Upgrade their skills. They will reward you.

Of course, Jim Pinto always has something to say, and it is his view that distributed manufacturing is a must. We do not have the consumption rates as we once did locally, and we can’t build plants for this reduced consumption. Think factory in a truck. So instead of having 10 people in one spot, you might have 20 people in 10 spots. This would also distribute the wealth that manufacturing creates.

Rockwell Automation CEO Keith Nosbusch agreed, as he spoke at the National Summit in Detroit. He suggests that federal R&D and economic stimulus needs to focus on industrial automation and information technology at levels not seen since the ’70s.

PLC inventor Dick Morley consulted with John Deere some time ago about product development because they were losing market share in the big-rig business. He told them to go small, like a Bobcat, for instance. Sell more for less. It worked.

I can’t remember where I read this, but more people are enrolling and graduating from business-type courses than engineering by a wide margin. The lure of Wall Street and the money tree is taking some of the most brilliant minds away from science and engineering. It had to be a “math” mind, not a financial mind, to dream up the derivative ideas.

Treat top customers as top customers. Treat your top performers as top performers. Train them. Upgrade their skills. They will reward you.

JEREMY POLLARD has been writing about technology and software issues for many years. Publisher of The Software User Online, he has been involved in control system programming and training for more than 25 years.
Machine Automation Has Come a Long Way. Technology’s Advance Won’t Stop Here. There’s a Lot More to Do

by Dan Hebert, PE, senior technical editor

AS THE WORLDWIDE economy continues to improve, long-term trends in machine automation begin to come into focus. Short-term panic is being replaced by more optimistic visions of the future—a future that will depend on safe, low-cost and efficient manufacturing.

A key component of improved manufacturing will be better machines and robots, but the definition of “better” is changing before our eyes as production requirements and needs evolve. Performance indicators of the past such as high throughput and low upfront costs are being replaced by new primary objectives such as flexibility and low lifecycle costs.

Features such as connectivity to higher-level computing systems that were once an afterthought are now a key requirement. Wireless is entering the mainstream, and computing advances from the commercial world continue to spill into the industrial arena.

Bend, but Don’t Break
Perhaps the most important machine automation trend is flexible production. Machines need to be reconfigured on the fly to produce different products, and this flexibility must be supplied with ease-of-use.

GAZE INTO THE FUTURE
You don’t need a crystal ball to see into the short-term future of machine controls and automation. Several trends have surfaced, but still more are on the horizon. What do you see? Read what others think, and add your input on this issue at www.ControlDesign.com/2010trends.
“We see full or partially automated changeovers as a key trend for our machines and their automation systems,” says Dave Zurlinden, president of Pro Pack Systems (www.propacksystems.com) in Salinas, Calif. Pro Pack makes fully automatic packaging machines and systems including case printer/erector/bottom sealers, case packers and case sealers. “We implement changeovers via recipe storage and retrieval from the HMI,” relates Zurlinden. “An operator simply selects the desired recipe at changeover, which commands servos to resize the machine to the next case recipe. The obvious benefit is dramatically reduced changeover time.” A less-obvious benefit is changeover repeatability from elimination of human-induced setup errors.

An important consideration when integrating a recipe management system, notes Michael Gurney, principal at Concept Systems (www.conceptsinc.com) in Albany, Ore., is whether equipment upgrades are required to support automated changeover. “Equipment not initially equipped with recipe management likely doesn’t have the required automation, and might need more mechanical and control system modifications,” he cautions.

“Consider a cookie manufacturer making product for branded and generic markets,” says Ted Wodolsawsky, vice president of marketing at ABB Robotics. ABB manufactures four- and six-axis articulated robots and a high-speed, four-axis delta robot. “The branded cookies come six or 12 in a package, regardless of raw material cost. The number of cookies in the generic package varies with the raw material costs. The manufacturer needs the ability to change pack count quickly to serve both markets.”

Automation provides flexibility, especially when delivered in software rather than hardware. “One of our end users continues to find new ways to apply the control system in ways never anticipated in the initial
“project,” observes Lee Hilpert, president of system integrator HilTech Engineering (www.hiltecheng.com) in Tomball, Texas.

Where Are All the Workers?
Despite relatively high unemployment, it’s difficult and expensive to find and retain highly skilled manufacturing employees. Because skilled factory labor is such a valuable and rare commodity, a powerful long-term trend is to augment labor with automation.

This takes a number of forms. Automation makes machines easier to operate and maintain. Automation is used to replace labor, in the process, often improving the quality of the end product. Finally, automation is used to make machines safer to operate, protecting valuable factory workers from harm.

A RECIPE FOR QUICK CHANGEOVER
Pro Pack Systems builds fully automatic, high-speed machines used to print and set up corrugated shipping containers prior to packing. They feature a recipe-driven servo-controlled changeover system to automatically reset machine parameters when case sizes change, speeding changeover time and eliminating setup errors.

Wired or wireless?
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Ease-of-use from intelligent automation is here to stay. “With intelligent design, automation makes the human interface to machines more efficient,” explains Pro Pack’s Zurlinden. “HMIs and PLCs can provide maintenance reminders and include signoffs to indicate when work is done. PLC programming can include predictive maintenance based on actual machine use and other measured parameters.”

One way to replace labor with automation is with robots. “High-end machine vision and force feedback allow robots to perform tasks once limited to people,” explains ABB’s Wodoslawsky. “Single-camera, 3D machine vision can be used to assemble complex components in tighter spaces than could be achieved with dual cameras or with a single camera and a laser system.”

Force feedback and control give robots the ability to feel, and this technology can enable refined finishing of metal objects or assembly. “Installing a torque converter into an automatic transmission used to be a manual operation,” notes Wodoslawsky. “A worker had to feel for the splines and then push the torque converter onto the shaft. Force control means a robot can now do this repetitive task with ease.”

Safer systems not only protect workers, they also can reduce a manufacturer’s liability. “Control panels are being specified with side-car breakers that cut live power to the panel, eliminating the need for personal protective equipment and making the panels safer to maintain,” notes Mike Triassi, business development manager at systems integrator and custom machine builder Optimization (www.optimization.us) in Rush, N.Y. “Safety PLCs in place of safety relays gain flexibility while maintaining the redundant algorithms and run-time lockouts needed to meet safety integrated level (SIL) requirements and NFPA regulations.”

**TOP TRENDS**

1. Flexible production
2. Automation augments labor
3. Customers demand more support
4. Customers drive standards compliance
5. Multi-core processors
6. Wireless

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One-Stop Shopping
Because skilled manufacturing labor is scarce and expensive, machine users demand more support from their suppliers if there's trouble. "Our customers want single-source responsibility," says Branko Bekic, electrical department manager at PMI Cartoning (www.pmicartoning.com) in Elk Grove Village, Ill. PMI designs and builds cartoning machines and case packers for the food, beverage, confectionery, cosmetic and pharmaceutical industries. "Our customers need a machine builder to be involved with the entire packaging line from initial design through commissioning to after-sales service," explains Bekic. "We stock parts for our customers and perform other logistical services, freeing them from warehousing requirements."

For suppliers, support is a global affair. "International markets are an important target for machine builders to remain competitive," observes Paul Ruland, product marketing manager for automation systems at Siemens Industry (www.industry.siemens.com). "Machine builders look for global support from automation suppliers. They'll have to manufacture equipment in multiple locations worldwide and source the same automation products locally with worldwide certifications and product approvals, with consistent lead times, and at globally agreed prices." Ruland argues that OEMs will install their equipment in a wider variety of customer locations with a standard set of globally acceptable technologies.

A key service component is remote support. "With standards-based networking such as Ethernet, OEMs can remotely debug problems and make upgrades quickly and easily," notes Bill Savela, marketing manager at Delta Computer Systems (www.deltamotion.com). "In the old days, engineers often dropped what they were doing to fly cross-country at a moment's notice. Now companies provide service that is just as responsive, or more so, without the travel costs and the carbon fuel burn."

Demands for Compliance
Standards continue to proliferate, often driven by end-user demands. "Our customers ask us to use state-model programming conforming to the OMAC PackML standard," says Scott Bivens, PE, electrical engineering manager for Oystar Packaging Technologies (www.oystar.packt.com) in Davenport, Iowa. "They also ask for
standard means to transfer information from the factory floor to the office and for third-party approval on controls from agencies such as TÜV and UL."

Oystar makes packaging machinery for industries that include food, meat, dairy, pharmaceuticals, explosives and cosmetics. "We see more and more requests for standards compliance in customer specifications, mostly from the big guys such as Kraft, P&G and General Mills," notes Bivens. "We usually quote compliance as an option because it increases engineering and material expense for us."

Rockwell Automation (www.rockwellautomation.com) believes modular programming and standardization drive costs out of the design and build process. "Much time is spent during machine design on programming, so reusing modular code can reduce debug, startup and commissioning time," says Sandy Holden, OEM market development manager at Rockwell. "From an end-user standpoint, modular programming standards can speed startups and minimize the learning curve for engineering and maintenance personnel."

Multi-Core to the Fore
Multi-core processors initially were designed to increase the performance of commercial PCs but are a good fit for many automation applications. "Automation systems are increasingly modular with..."
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real-time control, simulation, SCADA and other apps,” observes Optimation’s Triassi. “Multi-core machines simultaneously running multiple operating systems in a virtual machine (VM) environment allow many applications to execute in one PC.” He says products such as VMWare and a single PC can host your runtime environment or simulation on a Windows VM, while supervisory software uses a separate Windows VM, your legacy scanning system is on an MS-DOS VM, and the operator interface runs on a Linux VM.

The days when a manufacturer could turn out the same high margin product profitably for years on end are gone.

Beckhoff Automation (www.beckhoff.com) sees multicore processing as a key component in what it calls “scientific automation.” Machines will harness the full power of multi-core PC processors integrating two, four or eight cores along with ultra-high-speed networks such as EtherCat to be more intelligent and more productive, believes Graham Harris, president of Beckhoff Automation. “This will allow machine technology to evolve toward drastically reduced downtime, far less wasted material and incredible gains in throughput,” he says. “One multi-core industrial PC soon will manage all of a machine’s automation functions including traditional PLC control, multi-axis motion, safety, HMI, condition monitoring, robotics, vision and more.”

Wireless Finally Arrives

The promise of wireless has been on the distant horizon for years, but it’s now in the immediate future for many. “Wireless gives machine builders an effective, low-cost way to connect to remotely located machines, and perform remote monitoring, diagnostics and control,” says Ben Orchard, application engineer at Opto 22 (www.opto22.com). “We’ve seen the development of WirelessHART, security enhancements to the 802.11 specifications and development of wireless controllers and I/O by automation and control vendors.” Orchard thinks we’ll see continued proliferation of wireless as it becomes more robust and “erroneous notions and fears about its lack of security are dispelled.”

For many industrial applications, wireless is a natural next step. “A decade ago, machine builders transitioned from using hundreds of wires within a system to one network cable,” notes Charlie Norz, product manager at Wago (www.wago.us). “If a customer has one of your processing machines and purchases a bottling machine, wireless makes networking easy. Simply mount one antenna on the existing machine and you’re done.”

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Are Your Controls Digital-Healthy?

Growing Use of Fieldbus, Ethernet and Wireless Means Better Monitoring and Diagnostics, but How Do You Troubleshoot Your Control System?

by Mike Bacidore, managing editor

THE SIGNIFICANT UPSIDE of the diagnostics, maintenance and troubleshooting benefits that a digital network provides is all too alluring to ignore. Digital diagnostics provide more and better information that helps to troubleshoot and fix problems, and without shutting down the entire system.

Eric Rice, director of technical support for North America at FKI Logistex (www.fkilogistex.com), Cincinnati, which designs and builds conveyance and palletizing machines, agrees that, from a cost standpoint, the digital network makes a lot of sense.

“You don’t really gain anything in speed because the digital network is a little slower,” he explains. “But the amount of diagnostics you have is better. If you have an issue in one part of the system, it doesn’t mean the entire system is down. Subsystems can run independently, and you have more uptime. In today’s conveyor system, digital networks are the lifeblood.”

Digital Troubleshooting

With the wave of digital adoption, diagnostics have changed, but only slightly. “Our products’ digital signals consist of 24 Vdc I/O signals and Ethernet I/P,” says Wade Peterson, electrical engineer at CMD (www.cmd-corp.com), builder of bag- and pouchmaking equipment in Appleton, Wis. “Typically, digital signal problems for us are rare as our machines have a very small footprint and the cables are well-shielded and isolated from noise. Most problems are typically wiring-related like a broken conductor or nicked insulation. Our troubleshooting methods therefore focus on the media first.”

The best first step could be doing a visual inspection, says Jack Chopper, chief electrical engineer at Filamatic (www.filamatic.com), a liquid filling and packaging machine builder in Baltimore. “Fortunately, we don’t encounter very many digital signal problems, but we’ll use network analyzers and testers, both hardware and software, built-in diagnostic tools, recording instruments, multimeters and scope meters.”

The tools of choice seem consistent from machine builder to machine builder. “We typically troubleshoot with a combination of multimeter, oscilloscope and PC-based tools,” adds Peterson.

From a signal troubleshooting standpoint, the most frequently used equipment at FKI Logistex is a multimeter. “Those kinds of checks are done on-site,” says FKI Logistex’s Rice. “From a network point, different buses have different values we look for. For a Profibus network, we have a Profibus monitor. We look at the integrity of the network. We can do the same thing for Ethernet. We also have some proprietary networks that have resis-
tance values. If it’s out of specification, you could see intermittent issues with that piece of equipment. We have Ethernet sniffers—software or hardware—we would use to troubleshoot or get statistics.”

At MAG Americas (www.mag-ias.com), it’s done in two different ways. “In the machine realm, for qualification, some tools are provided by our suppliers, like Fanuc or Siemens,” says Jim Braun, vice president, product development and standardization for MAG, a large machine tool and systems company in Hebron, Ky. “We have other devices for tuning. We have Heidenhain scales. We have devices we can insert in the signal path or in the network—Profinet or Ethernet. That’s primarily on the machine qualification side. In the field, we have internally based diagnostic tools that run on the controls and give some pass/fail indications. We’re also looking at some other more advanced tools we haven’t released yet, like having a built-in scope feature inside the control.”

MAG uses a lot of Profinet and Ethernet-based interfaces that are proprietary to the control, and other parts of the machine may take special types of equipment, too (Figure 1).

“During the building and qualification of the machine, we have some tools to debug the machine,” explains Braun. “Once the machine is finished and it ships, if there would be a problem, we have remote diagnostics, but it’s only available on PC-based controls where we can request control of the machine and the person on-site can give us control.”

Digital Diagnostics

Most digital signal protocols include some form of error-checking or diagnostic information, explains Mara White, industrial Ethernet marketing manager at Fluke Networks (www.flukenetworks.com). “The more intelligence or sophistication built into the diagnostics, the more complex the measurements and analysis algorithms become,” says White. “This has an exponential impact on cost and can even lead to compromises in network performance. It is the compliance to digital protocol standards and the built-in diagnostics and error-checking that allow machine builders to integrate various subassemblies. This can be very effective for the non-custom jobs but also protects them when the line of transfer of ownership becomes an issue.”

When integrating multiple machines from a variety of vendors, use a combination of built-in machine diagnostics, diagnostic tools and appropriate maintenance strategies to ensure optimum performance, says White. “Relying solely on the machine’s diagnostics for equipment breaks can be a risky proposition,” she warns (Figure 2). “Testing and troubleshooting are a small cost that can save numerous hours and headaches during the initial troubleshooting and ongoing maintenance of the machine and network. The value increases with the mission-critical and time-sensitive nature of the work.”
Did You Check the Cable?
The best way to deal with troubleshooting is to not have the problem in the first place. "Many problems are ‘designed-in’ by users not following the specifications of the digital network," says Helge Hornis, PhD, manager, Intelligent Systems Group, Pepperl+Fuchs (www.pepperl-fuchs.com). "A network in which a segment must not be longer than 100 m—examples are Ethernet and AS-Interface—shouldn’t be set up to have 200 m cable. But if trouble somehow shows up, a combination of an oscilloscope that allows evolution of the waveform on the network and a dedicated analyzer that allows evaluation of the data packets traveling over the network is best."

Fluke Networks’ White recommends dissecting the node or segment into its finite elements, starting from the end device on the segment and working backward to the controller. Often an up-to-date blueprint can simplify this task, but the main elements can include the physical medium, signal properties such as amplitude, timing or baud rate and communications protocol.

"Inspect and check every connection, termination and cable for signs of wear or damage," suggests White. “Pay attention to cable installation length, connector wear and corrosion and even

Figure 2: As more processes are brought under the control of industrial Ethernet, the need to see all network devices, connections and traffic also increases. Relying solely on a machine’s own diagnostics can be risky. A diagnostic tool needs to present compete information in as simple a form as possible, plus be able to survive the rigors of the industrial world.

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quality of cables and connectors. Use an appropriate measurement tool to validate the cable properties are within the manufacturer’s or installation specifications. Critical parameters include impedance, capacitance, length, connector wiremap, cross talk and noise. It’s important to know if the cable installation can support the intended network communication performance rating. There are a variety of cable analyzers on the market measuring anything from basic continuity or application bandwidth to fully comprehensive detailed diagnostics.

Once the cable infrastructure is known to be good and within specification, the next step is to verify the electrical integrity of the digital signaling. Analyzing the signaling integrity can be broken down into two areas. “Check amplitude, frequency or transmission-rate characteristics,” says White.

“When integrating multiple machines from a variety of vendors, use a combination of built-in machine diagnostics, diagnostic tools and appropriate maintenance strategies.”

“Taking measurements at critical points across the entire segment can reveal signal attenuation or sensitivity problems or device setup conflicts. Then check for signal distortion, caused by cable impairments such as transmission signal reflections or external influences such as induced EMI from line power interference, random high-voltage transients or static discharges.” An oscilloscope with appropriate measurements and waveform capture and analysis capabilities can provide a visual insight into the quality of digital signals, she suggests.

Analyzing the network communications often has been seen as the role of the IT specialist, but, with TCP/IP-based networks rapidly being deployed in the industrial world, the maintenance professional is being asked to learn new technologies, techniques and tools. “Troubleshooting can be as simple as looking at the obvious, like network activity icons or indicators,” says White. “Non-invasively probing into the network and monitoring critical performance factors can lead you to localizing the problem. And testing an installation to validate whether or not it can support higher bandwidth or faster traffic can determine if production process speed improvements can be realized. A portable network protocol assistant with an Ethernet, wireless or fiberoptic interface can provide the measurements to diagnose TCP/IP-based problems on industrial networks.”

One more practice White recommends is baselining—documenting critical performance measurements at installation, before and after repair or when changes are performed. “Keeping accurate baseline measurements will allow you to compare and contrast tests, giving you the ability to quickly identify differences, thereby rapidly isolating problems,” she says.

The Relio R9 delivers RISC computing power in a compact, rugged package with wide operating temperature range and unmatched I/O connectivity.

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Focus

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If a picture is worth 1,000 words, then it also must be worth some lines of programming code. That’s the logic—no pun intended—behind graphical or object-oriented programming as it’s evolved and picked up new names in recent years.

Graphical programming’s basic premise is that images can be used and reused to represent functions that previously employed only text-based code. However, since these image-enabled programming methods gained acceptance and went mainstream, many users are deploying them in increasingly varied ways.

Some industrial machine automation and controls systems even seem poised to adopt graphical programming apps in the same way that Apple’s iPhones and iTouches do it.

“Graphical programming continues the natural paradigm of engineers using representations of their thought processes to approach and solve problems,” says Jeff Phillips, National Instruments’ (www.ni.com) LabView product marketing manager. “In the past, this meant boxes and arrows on a flowchart, and this has evolved into better representations on-screen. Graphical programming lines up better with how engineers’ minds work. In the past five years, we’ve seen the emergence of parallelism, in which multi-core and multi-threading increase processing power.”

Phillips says graphical programming also has been aided by better memory handling, which improves how compilers read graphical programs. “These improved data flows also improve graphical programming’s ability to represent state-based modeling applications,” he says.

In the future, Phillips predicts that the formerly separate buckets of graphical programming and CAD/CAM for HMIs will flow together. One effort already underway is called “hardware in the loop (HIL),” and it reportedly lets designers take their physical designs and use PC-based hardware to, for example, graphically simulate and test an engine’s entire dynamics in software.

“Not only is there much less typing with graphical and flowchart programming, but everyone from regular guys to Ph.Ds can grasp it and use its condition and action blocks with a few minutes of training,” adds Ben Orchard, applications engineer at Opto 22 (www.opto22.com). “Lately, many more powerful commands are available, such as our PAC Control 8.5’s Communications Handle, which users can program visually in a flowchart and then order their controllers to go out, pull down Web pages in devices and sift them for the parameters those controllers need to run.”

Dan DeYoung, marketing manager for Rockwell Automation’s (www.rockwellautomation.com) controller software division, says users want to decompose computer logic and break it into modular pieces for different applications, so they can interact with other functions and equipment. “Our RS Logix 5000 software decomposes logic via tasks, programs and routines that are linked to different phases of their machines and can monitor those phases,” he says. “We also see the evolution of off-the-shelf library functions such as RS Logix Architect, which can house the objects, functions and instructions that users employ, so they can create functional instructions without moving code.”

Besides software libraries, DeYoung reports that users can post and share sample programs and applications on Rockwell Automation’s website. These include simple applications that enable instruments to handle daylight-savings-time changes in their controllers or enable an HMI to access objects in a controller.

“One of our customers was building nine high-speed packaging machines and had separate teams each doing their own homing routines for their servos,” explains DeYoung. “They each had different tasks in different places, and so their code was inconsistent. We helped encapsulate their code in one library object. This let them drag it to their applications and tweak it as needed.” The result, says DeYoung, was more consistent with less effort.

“In the future, instead of having graphical programs that can be dragged from a library to machines, we’ll have software that’s more system-to-system and automatically can populate all the projects in an application at once,” predicts DeYoung.
A Computer for Every Application
Harsh-Environment Protection Contributes to Reliability

The most important feature to look for in an industrial computer depends on the application, says Ed Boutilier, president and CEO of Stealth.com (www.stealth.com). “An application may require protection from a harsh or dirty environment, or it may require advanced temperature, shock and vibration specifications,” he says. It could also be a situation where size and packaging of the industrial PC are important, depending on where it’s to be deployed. “Overall, the best feature is reliability—knowing that your industrial PC can be counted on for long-term operation,” says Boutilier.

Charles Chen, embedded business development manager at Moxa Americas (www.moxa.com), agrees that reliability is the key. “In a 24/7, mission-critical environment with no downtime, a rugged and solidly designed industrial computer becomes the most significant feature to have over programmability, performance or functionality,” he says.

“Only picking one feature is tough, but I would say the availability of rugged mass storage devices such as solid-state hard drives is the most important feature to look for in an industrial computer,” says Bjorn Falke, product marketing senior specialist, automation, Phoenix Contact (www.phoenixcontact.com). “These are designed to withstand challenges such as shock or vibration in an industrial environment. In the past, these solid-state drives were not available in the large sizes being offered today. In addition, the price of these drives has come down to a point where they’re suitable and affordable to use in industrial PCs.”

Corey McAtee, product manager at Beckhoff Automation (www.beckhoffautomation.com), believes scalability is key to finding the sweet spot. “When engineers are concerned with finding that controller sweet spot and balancing performance with budget, it’s invaluable to have a deep portfolio of controllers to choose from,” he says. “Of course, that bull’s-eye isn’t going to stay put forever, so it’s equally important to have the ability to move one way or the other over time as applications evolve and new markets are entered.”

Waterproof
WPC-500F waterproof, small-footprint, fanless computer meets IP67/NEMA 6 environmental specifications. The aluminum chassis acts as a heat sink to dissipate internal heat and provide noise-free operation. It uses Intel’s Atom processor, has power, video, serial and USB connections coupled through watertight, locking bayonet-style connectors, and operates 10-30 Vdc. Systems are compatible with Microsoft Vista/XP and Linux.

Stealth.com; 888/stealth; www.stealth.com

Reliable RELIO
The Relio R9 is based on the Atmel 200MIPS ARM9 RISC processor and features LCD and backlight controller, resistive touchscreen controller, one USB device and two USB host ports, CAN bus 2.0B interface and Windows CD 6.0 BSP Binary. Operating temperature ranges from -40 °C to +85 °C. Available with up to 256 MB RAM and 256 MB Flash memory, the standard I/O features Ethernet, serial, USB, CAN Bus, digital and analog interface.

Sealevel Systems; 864/843-4343; www.sealevel.com

Industrial Control
The NI 3110 industrial controller with an Intel SL9JT L2400 1.66 GHz Core duo processor and the NI 3100 industrial controller with an Intel 1.06 GHz Celeron M 423 processor are configured with the Windows XP operating system and designed for rugged applications that require fanless cooling and...
a wide range of connectivity to external devices through USB, cabled MXI Express, Ethernet and PCI or PCI Express.

**National Instruments;** 800/258-7022; www.ni.com

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**FAN-FREE OPERATION**

The housing of Automation PC 620 and Panel PC 700 provides for fan-free operation and includes Intel Atom N270 1.6 GHz processor optimized for small size and minimum power consumption. The new Atom generation can be equipped with up to 2 GB SDRAM, which can result in twice as much memory.

**B&R Industrial Automation;** 770/772-0400; www.br-automation.com

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**MODULE AND MOTHERBOARD**

bCOM2-L8000 COM Express module and miTX-945S-ED motherboard based on the 1.6 GHz version of the Intel Atom processor has one Gigabit Ethernet port, two Serial ATA interfaces, support for two IDE devices and eight USB 2.0 ports.

miTX-945S-ED has two Gigabit Ethernet ports, PCI Express and PCI expansion slots, a COM port, two Serial ATA ports, support for up to two IDE devices and four USB 2.0 ports.

**GE Fanuc Intelligent Platforms;** 864/672-8800; www.gefanucembedded.com

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**FANLESS EPC**

Fanless ePC-Series of industrial computers are available in 15-, 17- and 19-in. sizes with an Intel Atom N270 1.6 GHz processor. Removable SATA solid-state drives or Compact-Flash can replace the standard hard drive. These drives carry a five-year part warranty and are rated -30 to 85 ºC and 150 G (11 msec) operation.

**Nematron;** 734/214-2000; www.nematron.com

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**VALUELINE**

ValueLine industrial PCs with fanless design, 15- or 17-in. TFT touchscreens, Core 2 Duo 1.5 GHz or Celeron M1.0 GHz CPUs, up to 4 GB DDR-RAM and 64 GB solid-state hard drives (SSHD) have dual, independent 10/100/1000 Ethernet ports. Extended temperature range models are available and optional PCI slots can be added for connectivity to an I/O fieldbus. The design provides access to the removable hard-drive chassis, two CF slots and real-time clock battery.

**Phoenix Contact;** 800/586-5525; www.phoenixcontact.com

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**PASSIVE COOLING**

With Intel Atom processors, C6915 IPCs have up to 1.6 GHz processing power and two independent Ethernet interfaces. Passive cooling is achieved through the PC’s aluminum surface and enables operation at temperatures up to 55 ºC. Solid-state configuration features a flash disk.

**Beckhoff Automation;** 952/890-0000; www.beckhoffautomation.com

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controldesign.com
MICROBOX PC
Simatic IPC427C compact Microbox PC includes the Intel Core 2 Duo processor and is designed to operate at ambient temperatures of 0-50 °C. Measuring 262x134x47 mm, the PC’s main memory can be increased up to 4 gigabytes. Extended program storage is available on a hard disk drive with 32 gigabytes or up to two Compact Flash cards each with 8 gigabytes. The device features four USB 2.0 ports and two 10/100/1000 MB Ethernet ports.

Siemens Industry; 800/241-4463; www.siemens.com/simatic-pc

BEATS THE HEAT
APL3000 industrial PCs have a 2 GHz Intel Core Duo CPU with expanded memory, up to 4 GB of RAM. A Factory Alert System monitors PC health and generates instant notifications about excessive heat exposure, impending hard-drive or fan failure, CPU or power troubles. Hot-swappable hard drives and RAID-enabled redundancy protect data.

Pro-face America; 734/429-4971; www.profaceamerica.com

MORE, MORE, MORE
Find more industrial computers from companies such as Advantech, Arista, Cier Computer, Comark, Kontron, Moxa Americas, Omron Electronics, Pepperl+Fuchs, ProSoft Technology, Rockwell Automation and Schneider Electric at www.ControlDesign.com/roundupsarchive.
Data Vista Gets Smaller, More Digital

**DIGITAL SIGNALS AND** smaller footprints are two of the technological enhancements to signal conditioning that have changed the data landscape over the past decade.

“Digital signal processing (DSP) lets users replace application-specific signal-conditioning modules with universal-input and output signal-conditioning modules that are configured easily using DIP switches, push buttons or special software,” says George Tsakir, process and fluid power product manager, AutomationDirect (www.automationdirect.com). “Compact module designs, higher accuracy, faster response times and the ability to communicate over a network or the Internet are enhancements made possible by DSP.”

To bridge the gap between the signal conditioners manually configured with DIP switches and push buttons and modules requiring special software, a new breed of universal signal conditioner is configured and calibrated using an LCD display and keypad.

“As technology has advanced along with the diversity of applications, the number of dedicated signal conditioners required for the different inputs and necessary outputs has become cumbersome,” explains Jeff Thornton, product manager, Red Lion (www.redlion.net). “Universal signal conditioners—which can accept potentiometer, Ohm, dc current and voltage input, as well as output necessary analog signals—provide a solution by simplifying conditioning for numerous devices and allowing reduced inventories. Universal signal-conditioner technology, combined with custom-calibration capabilities, allow for more than 100 input-to-output configurations.”

Processing power available per-channel has risen dramatically over the past decade, explains Ian Lewis, senior vice president, Microstar Laboratories (www.mstarlabs.com). “In many applications, performing noise reduction and other processing on digital data streams makes sense for millions of samples per second, even in relatively low-cost systems,” he says. “This same technology allows data transfer into a normal PC at millions of samples per second, as long as latency isn’t an issue in the application.”

The reduction in the size of signal conditioners has had a huge impact, says John Lehman, engineering manager, Dataforth (www.dataforth.com). “Given today’s widespread use of embedded and portable applications, miniature size was essential,” he says. “It’s possible to incorporate high-performance, isolated, modular I/O on a per-channel basis for any embedded monitoring or measurement and control system.”

All types of industrial electronics have shrunk over the past decade. “This is particularly true for analog signal conditioners, where the benefits of both module package size reduction, combined with performance and functionality improvements, have come from developments, such as with planar transformers, microcontrollers and surface-mount components,” explains Alan Balcombe, global product engineering manager, Weidmüller Application Center (www.weidmuller.com).

“Taking the familiar Christmas-tree shape, the most space-efficient signal conditioners often accompany pluggable relays for a system approach to signal isolation with a common profile,” says Michelle Goeman, product manager—terminal blocks and electronic interface, Wago (www.wago.com). “Compact size also has changed jumpering. To retain a common profile and true dimensions, leading signal conditioners use push-in jumpers—a flexible comb-style bar. Every conductor has a corresponding jumper slot.”

One potential problem with miniaturization actually can have an upside. “When you put electronics into a smaller package, namely the popular 6-mm-wide products, one of the possible issues you face is increased heat buildup,” says Derek Sackett, product marketing lead specialist, Interface, Phoenix Contact (www.phoenixcon.com). “If it’s done correctly, a benefit of designing the needed electronic circuitry into a smaller housing size is increased power circuitry efficiency,” explains Sackett. “This in turn reduces power consumption and heat dissipation, increasing electronic component life and reducing enclosure heat buildup.”
WE BUILD SOME pretty basic machines that have only limited need for variable speed control of 240/480 Vac motors from 5 to 20 hp. That’s going to change as we expand the machines’ capabilities and design them to integrate into systems. We’re arguing about whether to switch from full-voltage starters to either VFDs or soft starters. We think we could save energy costs with VFDs because we sometimes run at faster speeds than we need to, but that’s not a big deal at the moment. Soft starts would clearly be easier on the system at startup. Cost can’t be ignored.

—from October ’09 CONTROL DESIGN

Weigh the Advantages

Soft start controllers are able to smoothly ramp up the motor and therefore can reduce mechanical and electrodynamic stresses in the system. Soft starting reduces downtime and lowers costs.

Variable frequency drives provide similar advantages to soft starters. When variable-speed control is required, then the drive is the most appropriate controller. This also means that when rated RPM is not needed, the drive can provide tangible energy efficiencies. Further, variable frequency drives can provide higher initial torque.
When variable speed and high torque are not essential, soft starts might be a better option, compared to drives, because soft starters are smaller in size and do not typically necessitate a change in enclosure sizes or additional assemblies. They also are less expensive, and heat losses are less.

**RAM TENNETI**, product manager, soft starters and machinery drives, Eaton, www.eaton.com

**Energy Costs**
When building a machine that has a basic version and an integrated version, it’s better to have a common approach to hardware. More specifically, using VFDs for both makes sense from the design, build, support and operation of the machine. The basic version could use terminal controls; any speed setpoint changes must be made in the drive. The integrated units could use a fieldbus or gateway to enable full control from an upper-level controller. The integrated unit will require less wiring and PLC hardware than the terminal-controlled units, simplifying the electrical drawings, building and controls.

Energy costs for the system can be 90% of the follow-up costs for the machine. This should be considered and can be a selling feature for OEMs.

With a VFD, you can see the actual load of the motor, both total current and the active current doing the work. This can be used to ensure the machine has been assembled correctly and is functional when compared to a baseline.

**STEPHEN SPROULE**, motion control product engineer, SEW Eurodrive, www.seweurodrive.com

**Untapped Potential**
Variable speed drives can reduce the energy used in manufacturing processes significantly, particularly those that involve fans or pumps with changing flow rates. Using variable frequency drives to lower speed or flow by just 20% might reduce energy use by 50%.

The VFD works on the principle that the ac line voltage is converted to a dc voltage. This dc voltage is then inverted back to a pulsed dc whose RMS value simulates an ac voltage. The output frequency of this ac voltage normally varies from 0 V up to the ac input line frequency. On certain applications, the frequency could go above the line frequency. The most common VFDs manufactured today work using pulse-width modulation to create the output sine wave. The conducting components used in drives are diodes, SCRs, transistors and IGBTs.

The soft starter operates on a different premise. This principle is that by adjusting the voltage applied to the motor during starting, the current and torque characteristics can be limited and controlled. By using six SCRs in a back-to-back configuration, the soft starter is able to regulate the voltage applied to the motor during starting from 0 V up to line voltage. Unlike the VFD, line frequency is always applied to the motor. Only the voltage changes.

A speed-related advantage of an inverter relates to processes that require a constant speed. If a fixed frequency is applied to a motor, the actual speed of that motor is not precisely regulated by the input frequency. The load applied to the motor regulates the output speed. So, if a process requires very tight speed regulation, the frequency applied to the motor must be changed in relation to the load that is applied. With the use of feedback to the VFD, this can be accomplished. Again, the soft starter only applies line frequency, so speed regulation is not possible.

On applications for which acceleration time needs to be consistent, an inverter should be used. Acceleration time for a soft starter is more dependent on the load than the selected ramp time. If

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**FEBRUARY’S PROBLEM**

**WE ALWAYS USE** stepper motors in our semiconductor processing machinery with great success, but we’re looking to cut costs. I’ve heard it’s possible to combine some of the newer VFDs with standard induction motors and attain performance close to stepper levels for less money. Does anyone have any experience with this type of an application? If so, what are the pluses and minuses?

**SEND US YOUR COMMENTS, SUGGESTIONS OR SOLUTIONS FOR THIS PROBLEM.** We’ll include it in the February ’10 issue, and post it on ControlDesign.com. Send visuals if you’d like—a sketch is fine. Email us at RealAnswers@putman.net. Please include your company, location and title in the response.

**HAVE A PROBLEM YOU’D LIKE TO POSE** to the readers? Send it along, too.

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controldesign.com
acceleration time is not an issue and controlling the torque or current is what is needed, a soft starter is a good candidate. If limiting current is the prime reason for not starting at full voltage, the first method to be considered today is usually soft starters. This is due to the cost differential between a soft starter and a VFD at the Ampere ratings that current limiting becomes a factor. In most instances, the soft starter is an appropriate choice.

There are applications where the additional cost of an inverter is appropriate, for example, if the motor can’t provide sufficient torque to start the load with the current limitations imposed by the distribution system. Unlike soft starters, drives can accelerate a motor to full speed at full load torque with line current that doesn’t exceed the full load Amps of the motor.

If starting torque is a concern when selecting a drive or starter, keep in mind the drastic difference in the amount of torque that can be developed for a given amount of line current. The drive has a much higher torque-per-Amp ratio.

For example, an overland conveyor requires 100% torque to accelerate when starting fully loaded. The maximum current draw from the utility is limited to 500% of the motor full load Amps. The conveyor normally will be started unloaded; however, on occasion it might need to be started when it is loaded. Rate of acceleration is critical to prevent the conveyor belt from being damaged. Initially, a soft starter seems to be the correct choice. The soft starter can provide 101% torque with 450% current, but the acceleration rate, which equates to starting time, is critical. The load also varies from unloaded to fully loaded. In this case, a VFD would be the correct solution.

SHARON JAMES, application engineer, Rockwell Automation, www.rockwellautomation.com
Smart Board Reduces Costs

AUTOMATION SPECIFIERS AND users want control system components to be low-cost, small in size and more connected to each other and to management systems and to remote locations. Users also demand high-performance and security from these solutions.

Today’s typical control cabinets can include a controller and I/O, Ethernet switch and/or modem with firewall, protocol converters and associated required cabling and power supplies, most of which add size, hardware and integration costs, as well as spare-parts requirements.

A single piece of hardware now can do all of these things, says Richard Hollenbeck, CTO at SoftPLC. “Our Smart products provide a local I/O interface to as many as 3,072 I/O, an open architecture interface to virtually any industrial bus/motion control card or any PCI-104 card, remote I/O interface, an Ethernet switch, router, VPN, power-over-Ethernet (PoE) device and communications gateway,” says Hollenbeck. “We eliminate between two and 10 components in a control cabinet by combining them into one piece.”

These functions are combined in a line of products that includes PACs, I/O adapters and communication gateways, which provide protocol conversion, Ethernet routing and remote access services. “Features can be combined as needed to meet application requirements,” says Hollenbeck. “All Smart products include a rich set of base functionality that allows users to minimize control cabinet components and communications cabling without sacrificing functionality. As an engineer’s choice, it’s just plain smart. The same low-cost hardware can be used as a ruggedized Ethernet switch, remote serial server, modem, I/O adapter, firewall/router and protocol converter. Yet it is also one of the most flexible and powerful PACs available.”

At the heart of every Smart product, says Hollenbeck, is SoftPLC’s SmartBoard, a low-power CPU that runs on 12-48 Vdc, packaged in a DIN-rail mountable metal enclosure. A wide array of communication connections is standard. SmartBoard is a managed 10/100 Ethernet switch with four ports—three copper and one fiber—that also supports PoE.

Five serial ports are provided, plus another port that can be used for a phone modem or customized interfaces such as CANbus or an A-B remote I/O port. A PCI-104 bus interface provides access to DeviceNet, Profibus, wireless/GSM modem and motion control cards.

“An abundant amount of user application memory includes 63 MB of RAM and support for both Compact and SD Flash disks,” says Hollenbeck. “Other hardware features are an FPGA with 32 I/O and a supercap backed up, real-time clock for maintenance-free, battery-free operation.”

SmartBoard also can be equipped with interface cards to SoftPLC’s Tealware I/O system, either as a Smart SoftPLC controller or a Smart I/O adapter. “For low-count I/O needs, be they small systems or distributed I/O drops, a Backplane3 card allows any three Tealware I/O modules to be mounted directly on the SmartBoard,” says Hollenbeck. “For systems requiring more I/O, the LocalPorts card can connect up to 12 Tealware I/O local racks, up to 96 modules/3,072 I/O, and scan them in less than 1 msec.”

With Smart Adapter, Tealware I/O also can be used in distributed remote systems over ModbusTCP Ethernet, says Hollenbeck. “One feature of this configuration is that if communication to the master is lost, the Smart Adapter can automatically morph into control mode for localized control until communication is restored,” he says. “The Smart Adapter also provides intelligence to allow for user-defined actions upon faults, even down to the individual I/O point level.”

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Call 800/softplc, email sales@softplc.com or browse to www.softplc.com.
**PRODUCTS**

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Two-axis linear stepper motor gantries in lengths to 72 in. (both x and y axis) have an open loop accuracy of 0.001 in./ft and repeatability of 0.0004 in. For closed-loop operation, an optional encoder is available. Full step resolution is 0.010 in.; however, when microstepped, step size resolution can be as small as 0.00004 in. Continuous force on both x and y axes is 6 lb; peak force is 8 lb.

H2W Technologies; 888/702-0540; www.h2wtech.com

**PROMASS EXTENDED**
Promass 83 Coriolis Mass Flow Meter provides multi-variable measurement, compact design, and EtherNet/IP connectivity in conjunction with the Logix platform and its PlantPAx solution for simpler installation, integration and reduced programming time. The device also integrates with Profinet, Foundation fieldbus and Modbus.

Endress+Hauser; 888/endress; www.us.endress.com

**FAN HEATER**
CR030/130 fan heater has a double-insulated plastic housing and can come as a DIN-rail panel or foot-mountable heater with integrated adjustable thermostat or fixed hydrostat. It comes equipped with a built-in temperature limiter. The CE-compliant product maintains minimum operation temperatures in enclosures and helps prevent failure of electronic components caused by condensation and corrosion.

Omega Engineering; 203/359-1660; www.omega.com

**SOFTWARE**

**REMOTE ACCESS**
Remote access and control feature for C-more operator touch panel line allows authorized users to connect a PC to the C-more panel from anywhere via an Internet Web browser. The feature resides in the panel and requires no option modules. Since applications can be downloaded from the C-more panel through a PC’s Web browser, authorized users can access and control the panel remotely without purchasing or downloading additional software packages.

AutomationDirect; 800/633-0405; www.automationdirect.com

**RESOURCES**

**SECURE WIRELESS CATALOG**
More than 200 new products are featured in B&B Electronics’ 2009 Q3 catalog, including Vlinx wireless device servers, Elinx Gigabit Ethernet media converters, plus software enhancements to the Zlinx wireless I/O line. The 136-page issue showcases Ethernet switches and gateways, wireless modems, serial converters, USB and remote I/O lines. Non-metal enclosures, terminal blocks, power supplies and surge protectors are available.

B&B Electronics Manufacturing; 800/346-3119; www.bb-elec.com

**FIBEROPTIC SENSORS BROCHURE**
Accurate detection of small objects in misty and dirty sensing environments was one reason E3X-DA-S fiberoptic amplifiers were upgraded with a stronger light source to extend sensing distance for all sensing modes—from high-speed to high-resolution—and to equalize for both standard (2 mm diameter) and thin fiber optic cables. By improving the uniformity of LED lighting across the interface with the cable, E3X-DA-S reduces energy usage by half compared to earlier models.

Omron Electronics; 800/55omron; www.omron247.com
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Contact: Polly Dickson
pdickson@putman.net
630-467-1300 ext. 396
It’s no secret that technology has advanced rapidly in the automation and control field over the past few decades. The world of pump control has not been immune to these advances. The advent of the PLC, the evolution of communication protocols and the introduction of modems and radios for data transfer all played significant roles in the capabilities we’re familiar with today. Now, Ethernet and Web-page functionality have found their ways into control panels, further advancing the industry.

As semiconductors evolved, ever-smaller devices became capable of collecting and storing more data. It wasn’t long until this type of “intelligence” appeared in motor starters, drives, soft starters and PLCs. These devices generated more data than the traditional on/off signals, gathering actual motor current, voltage, flow, level and other numerical data. This information can be useful for diagnostics or regulatory compliance purposes. At first, this technology mostly appeared in large-scale control systems, but not in stand-alone pump panels. There was a misconception that users could apply this higher functionality only in advanced custom control panels.

Ethernet and Web-page functionality have found their ways into control panels, further advancing the industry.

Our company has been building custom control solutions and predesigned configurable pump panels for more than 35 years. The custom panels often offer advanced benefits. Configurable or “rapid release” panels offer price and speed-of-delivery benefits. We believed there had to be a way to use the superior features of this technology in our custom panels and allow the control to be configurable in a manner similar to the traditional rapid release concept.

We partnered with Schneider Electric’s OEM Technology and Solutions Center to develop the design. The result is our Intelligent Station Controller (ISC), which provides run status, amperage (average, phase and ground fault), fault codes (including jam protection), motor thermal limit, alarms and other diagnostic information to help provide enhanced maintenance ability for customers. The advance diagnostics and maintenance data can help a utility predict anomalies and failures and increase the reliability of the pump station.

The data gathered using the ISC is displayed on an operator screen and logged and trended in an internal Web page. Stacon’s customers decide whether the Web pages are accessible through the Internet, through a dedicated Ethernet network that is not connected to the Internet or at the panel via a hardwired connection. Regardless of the level of access, a standard browser is all that’s needed to display these pages, eliminating specialized software and training. Additionally, the system stores user manuals for the panels. This allows access to all needed information with no risk of losing paper copies.

The ISC consists of motor starters, a Web server and an integrated HMI/PLC—all configured for serial Modbus and Modbus TCP Ethernet. This configuration allows each device to connect to each other through preassembled Cat. 5 cables. The plug-and-go technology reduces wiring time.

There are fewer components in the ISC than there are in a traditional pump panel. One example of this is the operator panel, which replaces all pilot lights and selector switches. In addition, this unit combines the PLC and HMI into one unit, further reducing panel space. Programming is simplified through one software package for the entire system. The combination of communication cables, Web server and HMI removes any remaining interposing relays, timers, counters, chart recorders, loop controllers and other devices.

Panel real estate is decreased with the use of space-saving devices such as self-protected, combination NEMA starters rather than traditional NEMA starters. This lets us use a smaller enclosure compared to a traditional pump panel. Furthermore, the combo starter generates less heat than melting-alloy-based NEMA starters, which can contribute to longer component life and greater panel reliability. Heat is a constant concern when working with control panels. Our ISC test panel is a NEMA 3R stainless steel panel installed in the central Florida sun with only filtered ventilation. Since its installation in April 2008, the panel has not suffered any heat-related failures.

Mark McCartney is president of Stacon (www.stacon.com) in Apopka, Fla.
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