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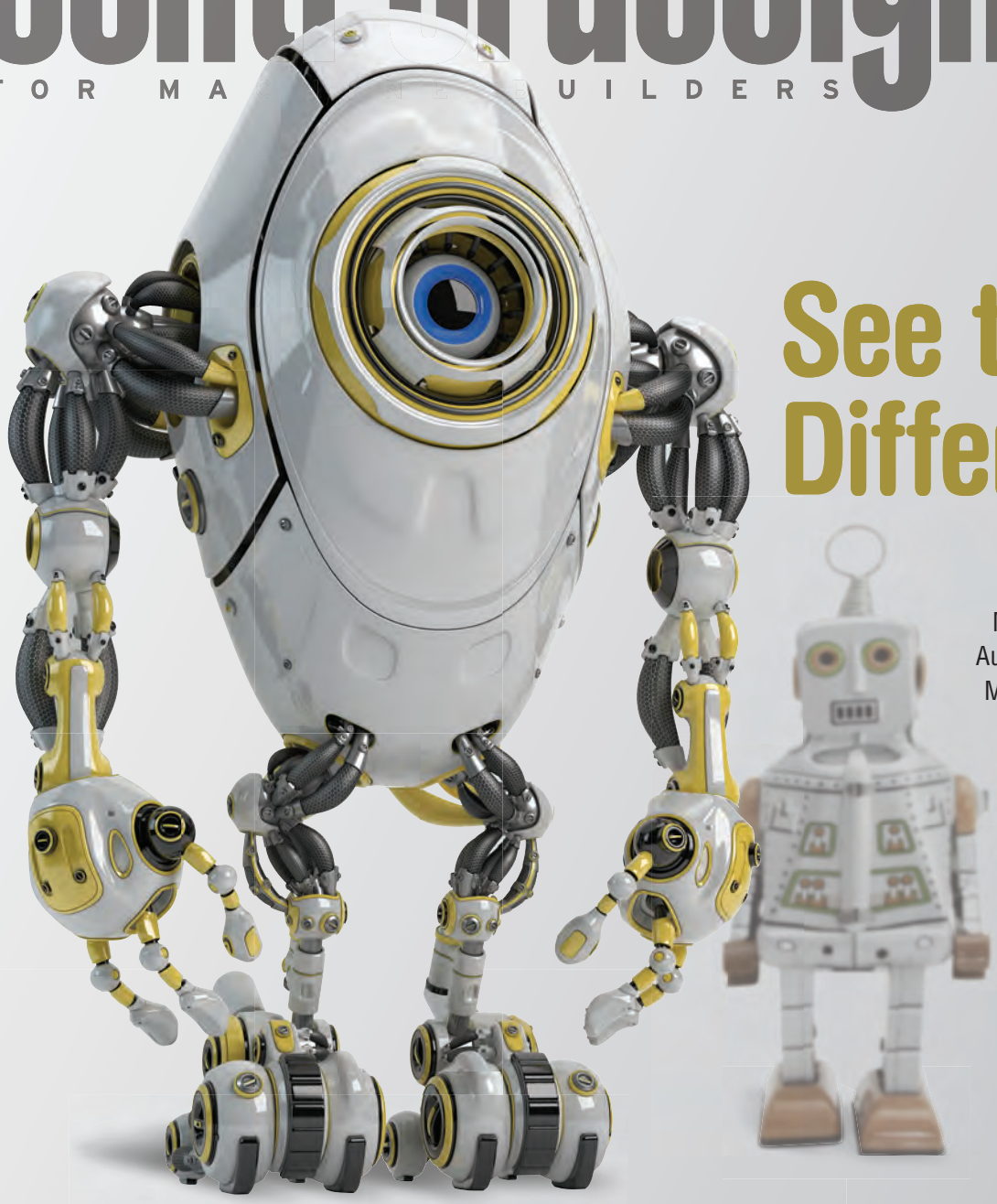

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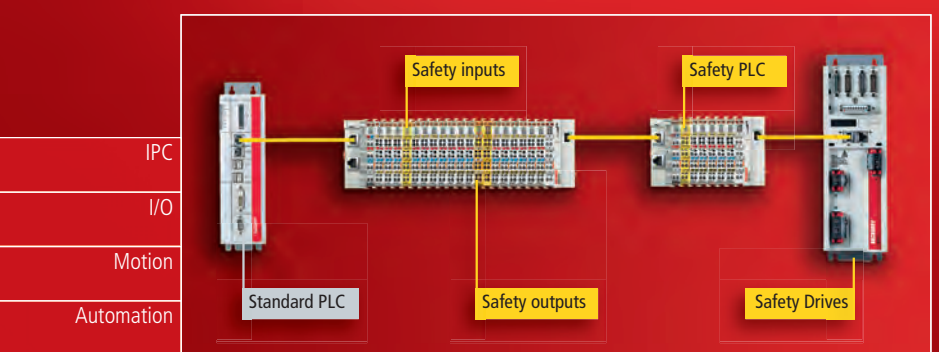

New Automation Technology **BECKHOFF**

FEATURES

COLUMNS

HOT BUTTONS

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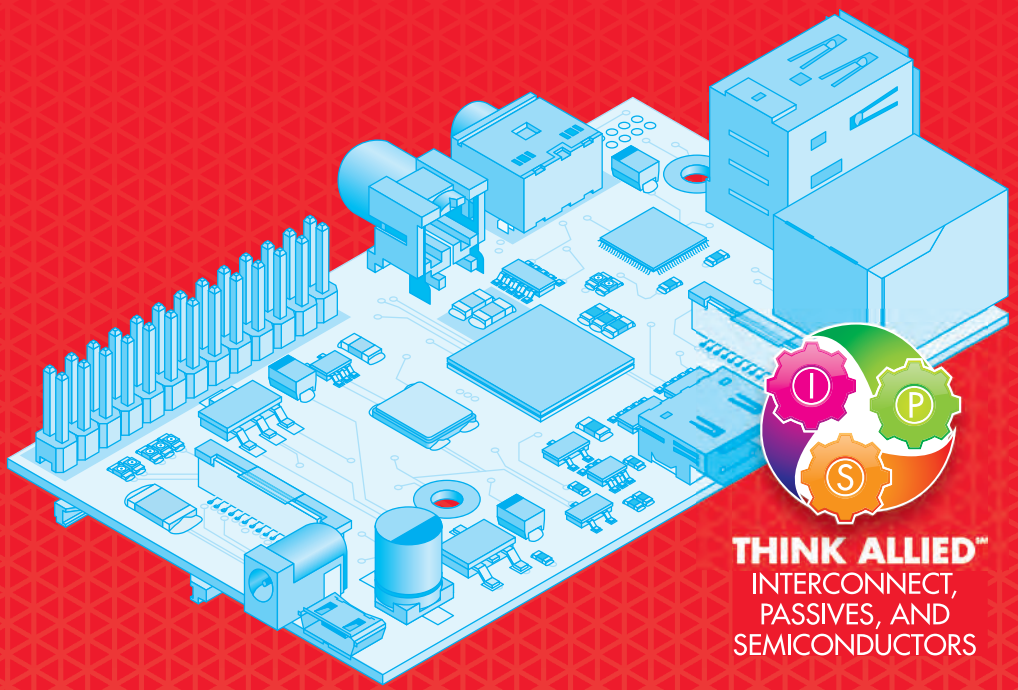

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Pumps & Pumping Equipment	785
Rolling Mill Machinery & Equipment	157
Semiconductor Manufacturing Machinery	1,403
Textile Machinery	232
Woodworking Machinery	275
Other Industries & Special Industrial Machinery & Equipment NEC	8,696
TOTAL	**40,020**

BPA WORLDWIDE
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We, the Digital Immigrants

LIKE MANY OF you who are in my age group, the recent "celebration" of the 30th anniversary of the commercial release of Apple's Macintosh PC made me recall my involvements with personal computing around that time.

With some exceptions, in the early 1980s most manufacturing companies saw no real use for personal computers—they were called home computers—except for starting to see their value in still-cumbersome-to-use word-processing programs, but the quality of that dot-matrix printer output wasn't exactly elegant. We also were trying out the time-saving number-crunching that early-generation VisiCalc spreadsheets offered.

It was sort of a given that, if a company did introduce PCs to the office, they were labeled IBM, not Apple, even though the Apple ii PC had been around since 1977 or so.

There certainly were engineers using Commodores and TRS-80s, but most were occupied with finding factory-floor uses for game-changing PLCs that were proving a very useful step up from relays.

My first home computer purchase in 1983 was an IBM XT model. Its galaxy-class specs included a 4.77-MHz processor; a fancy-dancy 10-MB hard drive; 128-KB RAM and a 360-KB, 5¼-in. floppy drive. I even sprang for the CGA color CRT. I was living in Europe then, so the exchange rate of the time might skewer this a bit, but it cost roughly $6,000. I gasp at that to this day.

Compaq had fired up its competitive product perhaps a year before, but I was clearly thinking under the spell of a consumer version of "nobody gets fired for buying IBM." And it was IBM and Apple—remember its 1984 Super Bowl Mac commercial?—that put home PCs on the mainstream radar.

A year or so before I bought my PC, I was at a coworker's house when he unveiled his recently purchased Osborne 1, touted as the world's first portable PC. Well, it did fold up to look like a plastic suitcase with a handle. It weighed 25 lbs. Under the hood there was a 4-MHz processor, two 5¼-in. floppy drives for 90-K capacity disks and a 5-in. monochrome CRT. It cost about $2,000. It also wasn't IBM-compatible, so neither it nor its maker lasted very long on the market.

My kids were pretty young when that home computer arrived, but they were immediately engaged by early versions of programs like Math Blaster and a similarly based spelling adventure. I recall having to create a few menu screens in MBASIC, so they could find them on the hard drive and not have to use a floppy. Today, their kids are the true digital natives.

> ■ If a company did introduce PCs to the office, they were labeled IBM, not Apple. ■

My perspective is shaped by those types of experiences. Share some of your recollections with us, regardless of when you entered the digital world.

Some of you will make me look like a late-to-the party kid, with your tales of playing with the precursor toys in the decade before.

Others of you are thinking, "Gee, I didn't think he was so old." It comes with the territory. CD

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Safety-Rated Speed Control

A MACHINE IN which all rotating parts are at a complete standstill is undoubtedly safe, but also most likely unproductive. But many machines have certain components that rotate at slow speeds that are safe to a degree, not only practically, but also according to standards.

In terms of standards, most require a risk assessment to determine levels of risk and required protective measures. "The three commonly used factors for assessing risk are the severity of injury, frequency of occurrence and possibility of avoidance," says Ian Brough, safety product manager at Sick (www.sickusa.com). "If a piece of machinery is moving very slowly or with low torque, all three of these factors are affected in some way. Severity and frequency could be affected slightly, but avoidance will be affected significantly in almost all cases."

Allowing operators to interact with these slowly rotating parts can allow increased production while still maintaining safe operations, greatly increasing productivity in many applications. The trick is to monitor the speed of the relevant rotating components in a simple yet safe manner, using control and sensing hardware that's cost-effective, easy to use and safety-rated.

This is often referred to as safety-rated speed control, and it's commonly achieved by monitoring rotary motion using multiple proximity sensors or encoders that connect to safety integrated modules (SIMs). SIMs produce a safety output that tells the user that the machine is completely stopped or below a certain predetermined speed deemed to be safe per the risk assessment.

A typical application for safety-rated speed control would be a machine that incorporates winding and/or unwinding operations. This could apply to anything that is wound on a roll, such as paper, metals or plastics.

For example, a paper roll machine might require paper to be fed into a newspaper printer or a slitter line. These rolls would need to be exchanged often and quickly, so the machine could be kept running. The exchange of the empty roll for a full roll could be very efficient if rotation were maintained, even at a slow speed. If the speed is safely limited, an operator can be in very close proximity, while the end of the new roll is tacked to the end of the emptying roll. The machine can keep running without having to be fully stopped while the rolls are exchanged.

Speed-sensing and other related technologies to accomplish the above have been around for quite some time, but now they can be integrated directly into drives and controllers on newer machines, instead of being supplied as an add-on.

For existing machines, new products are available that allow safety-rated speed control to be retrofitted, providing the same benefit. "Our safety controller with an added safety drive monitor allows a user to apply safe speed monitoring and control to drive systems that are currently in the field," Brough points out. "These controllers can be applied to all types of drives, and they include safe motion functions such as safe speed monitor, safe limited speed, safe direction indication, safe speed one and safe operating stop. These are just a few ISO-approved functions. There are about 22 in total."

Speed-sensing and other related technologies can be integrated directly into drives and controllers on newer machines, instead of being supplied as an add-on.

Another application for safety-rated speed control is the safeguarding of automated guided vehicles (AGVs) or carts. "Today, safety laser scanners are used as active 'optical bumpers' to ensure collisions don't happen," Brough explains. "Maximum speeds can't be attained unless large protective fields are used, and this can limit where AGVs can be most productive. If a user can safely switch these field areas based on safety-rated speed control, users gain productivity in a safe manner."

Essentially, the protective field area is increased as the speed of the AGV decreases and vice versa, allowing the AGV to operate at the maximum safe speed in each plant area.

With safety-rated speed control, the protective field area increases as the speed of the AGV decreases, and decreases as the speed of the AGV increases, allowing the AGV to operate at the maximum safe speed in each plant area.

Personnel often are tempted to work in areas that they deem safe due to low speeds of rotating or mobile equipment, but safety-rated speed control based on sound engineering principles takes that decision about allowing or prohibiting work out of their hands. CD

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So Long Windows, Good-Bye Ladder Logic?

Linux might make some inroads in the control world against Windows and good riddance. (See our October 2013 issue cover story, "Old Skills, New Skills," www.controldesign.com/articles/2013/bye-bye-windows-so-long-ladder/.) But the problem that stands in the way of extensive selection of Linux or any Linux-based hardware is one of control and version standardization. Today, one can buy a Windows version or, I suppose, an iOS version, and be very confident that the behavior of that OS is (reasonably) well-documented and very predictable down to the level of fine details.

But Linux, on the other hand, even a specific Linux version, is not really one OS. It is a hundred OS versions that have been tinkered with and tweaked by numerous people and organizations with little or any documentation. Fine for the small operator who is building one-off products or systems, but anathema for any large system or one that has to be able to be redeployed again and again over several years.

And as far as ladder logic is concerned, it will be with us for a long time to come. There is simply no other method of depicting logic that is so intuitively easy to understand and so little subject to interpretation about the fine details of the function of each element. There are a lot more maintenance people who can follow a ladder diagram than there are those who can understand SL or FBD. In addition, it's much easier to follow the signal flow when online monitoring a program in ladder logic than in SL or FBD. The other programming languages have gained popularity as more and more number crunching applications are being ported to PLCs and PACs, and as the programmers who write programming software discover that it's easier to put a complex analog function into FBD or SL format than it is to turn that function into a ladder element. Bottom line: ladder can do discrete logic better than any other method of visualization and can support complex function blocks, while the other languages have problems with visualization. They may handle analog better than ladder (arguable), but they are much more troublesome for discrete logic.

KIM GROUND
Senior EE - Controls
Surface Finishing Technologies,
Technic, www. technic.com

Is the Electric Car Dead?

I know that magazine articles need controversial headlines, but the electric car is not dead—far from it. (See "What Killed the Electric Car?," October 2013, www.controldesign.com/articles/2013/what-killed-the-electric-car/)

As a matter of fact, it is in marketing terms, an embryonic technology. The industry must try several solutions before settling down with one technology. We have several that you mentioned. So far, we don't have a turbine-powered hybrid yet—my favorite. All of these are now using lithium ion batteries, which have a poor energy density, but better than the current known alternatives. I think the future will yield better batteries or even ultra capacitors for energy storage.

The real revolution is the electric motor drive train. The inherent capability of the automotive electric motor drive is that it develops a large amount of torque at zero RPM (start-up) and requires no gears or differentials to separately power each wheel. Now we need time to evolve battery, fuel cell, ultra-capacitor technology. I fully believe that the age of the EV has not yet even begun—but it will.

DICK CARO, owner,
CMC Associates,www.cmc.us

What About Hydrogen?

I agree that it will take some time to change public opinion away from a cheap, hydrocarbon-based transportation system to some other method. I am rather fond of hydrogen fuel cells myself. Fill you car up with water. A Holy Grail when/if it ever comes.

THOMAS STEVIC,controls engineer,
Cincy Integration & Automation
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Time to Bark

I USUALLY AVOID State of the Union addresses like the plague. They're too full of vague generalities and unspecific promises that aren't kept anyway.

Still, like Pavlov's dog, I'm trained to salivate when I hear words or phrases close to any beat I'm covering. So when I heard that President Barack Obama was highlighting "high-tech manufacturing hubs" in his State of the Union address on Jan. 28, I checked out the many transcripts available online. Here's one: http://usat.ly/1d3GWJ4/.

About a third of the way in, President Obama stated, "We also have the chance, right now, to beat other countries in the race for the next wave of high-tech manufacturing jobs. And my administration's launched two hubs for high-tech manufacturing in Raleigh, N.C., and Youngstown, Ohio, where we've connected businesses to research universities that can help America lead the world in advanced technologies. Tonight I'm announcing we'll launch six more this year. Bipartisan bills in both houses could double the number of these hubs and the jobs they create. So get those bills to my desk and put more Americans back to work."

Very nice. As usual, still fairly general and unspecific and with few details on what the existing centers do, how the new ones train participants, and how they help U.S. manufacturing compete globally. Granted, it's probably impossible to cram these and all other deserving details into one speech, but these questions have to be answered at some point for the words to have actual meaning.

To me, "high-tech manufacturing hub" sounds like a very short hop, skip and jump to process control and automation. I'm playing favorites in favor of my beat, of course, but I think most politicians and business leaders have little or no idea what's really involved in making real high-tech manufacturing a living, breathing, profitable reality. If they did, we probably wouldn't have spent the past few decades letting Japan make all the VCRs, allowing China take over our rare-earth metals production and frittering away so many other opportunities for the "short-end money."

To their credit, the first of the 45 planned hubs in the National Network for Manufacturing Innovation (NNMI) has been up and running for about a year and a half. Located in Youngtown, it's called America Makes, the National Additive Manufacturing (AM) Institute (www.americamakes.us), and reports that it's a public-private partnership "working together to innovate and accelerate AM and 3-D printing (3DP) to increase our nation's global manufacturing competitiveness." The second, the Next Generation Power Electronics Innovation Institute, was unveiled by President Obama few days before his speech, and will be located at North Carolina State University. It will focus on making energy-efficient, high-power electronic chips and devices by making "wide bandgap semiconductor technologies cost-competitive with current silicon-based power electronics in the next five years."

Very commendable, but these two hubs and especially those in the future will need plenty of help if they're going to create jobs in large numbers, and that help is not going to come from the usual pie-in-the-sky boosters. God knows, you can't leave it up to politicians, marketers, (ahem) editors and other hucksters. These manufacturing hubs and all efforts like them will fail if you do.

> God knows, you can't leave it up to politicians, marketers, (ahem) editors and other hucksters.

Once again, process automation engineers and factory automation engineers are going to have get out from behind their traditional support roles, do some critically needed self-promotion, and remind everyone else what "high-tech manufacturing" really means and what it requires to succeed and generate jobs in real applications. I know this isn't easy. More than one engineer has told me, "I didn't get into engineering to talk to people."

Unfortunately, the stakes are too high for engineers, machine builders and other well-informed technical professionals to let their usual reluctance to hold them back. They and we must reach out from our side where high-tech really lives, speak out loudly about what's needed, participate where possible and even do a little evangelizing and old-style carnival barking to support these efforts and draw others to them. The much-feared brain drain and much-needed next generation of engineers won't grow up educated, aware and strong without support, encouragement and public advocacy from all sides by every present or retired engineer, machine builder or technician able to raise their voice.

So if you end up with one of these hubs or even something similar nearby, I'd recommend that you investigate, find out what it's all about and get involved in whatever capacity you can. At the very least, it'll be more interesting and useful than watching another YouTube video or playing another game of Candy Crush, right? CD

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Answers for industry.

A Story With a Lot of Holes

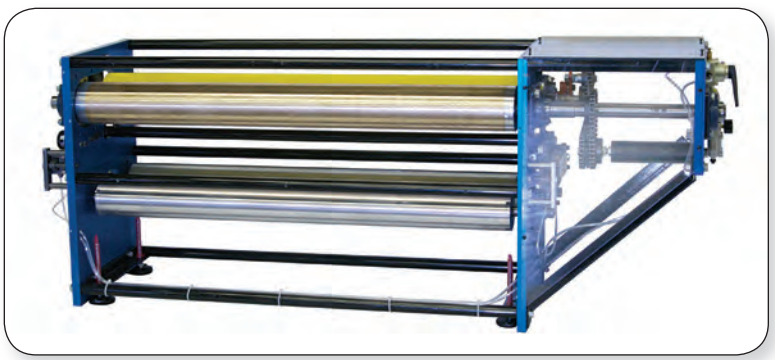
Experience and In-House Engineering Meet Customer Needs for Custom Perforation, Pinning and Support Equipment

THERE ARE MANY more holes in many more places doing many more important tasks than most of us realize. Paper and textiles are obvious, but how about making plastic bags breathable to better preserve produce, or micro-perforating paper sacks to let air out during filling, or needling racing tires to improve performance?

These are just a few of the applications to which Stewarts of America (www.stewartsofamerica.com) in Simpsonville, S.C., applies its nearly 140 years of expertise in pin technology. It provides nano, micro and macro perforating machines, tooling and services, precision drilled parts, embossing tooling and equipment, pinned products for textile processing, electronic drives, control panels and system integration services. Its perforating technologies include hot-needle, cold-needle, slit, laser, cross-web, thermal and customized solutions.

"We do standalone projects, but 90% of our machines are integrated into existing production lines with unwinders and rewinders or sheet loaders at either end," says Craig Jackson, Stewart's vice president. "Our motto is, 'If you need a hole in a substrate, we can put it there.'

"We consider everything from users' individual space considerations to the materials they're working with. Our customers talk directly to our engineers with no middle man," Jackson explains. "This is what really sets us apart. We have a full engineering staff in house, and we do all our own controls, control panels and automation. Because of the recent economic downturn, many of our competitors make cookie-cutter machines in a few, inflexible sizes. That's something we refused to do.



STEWARTS OF AMERICA

PERFORATION FOR VENTILATION

Stewarts of America's perforating units allow film manufacturers and converters to add value to what would otherwise be regular plastic film. These films now can breathe or allow permeation at a controlled rate.

"From time to time, we'll receive machines built by other manufacturers that require upgrades and/or modifications. Most of them are European, so having a local specialist is a huge advantage for our customers. When designing a perforator, the material's thickness, density, surface tension and resistance to perforating all have to be taken into consideration. Therefore, a bespoke machine tailored to each application is critical. The build quality of our machinery is such that it will take industrial applications in stride, while a one-size-fits-all machine just won't cut it."

Jackson adds that Stewarts' machines typically use standard electric motors, such as Baldor's Super E, and small ac drives from KB, ABB and Siemens, as well as variable-speed and reversible drives, especially for web-following applications. Though controls for perforating and pinning machines didn't need to be very complex in the past, some new motion-control requirements call for using PLCs, which were later upstaged by some HMIs that could perform those functions. Jackson says Stewarts usually employs Wonderware InTouch HMI software on Siemens HMI screens.

"Besides working with tough materials, we work with stretchable films and other very-thin and delicate materials, and again, we have to build our equipment accordingly," Jackson adds. "This means the drives and controls have to be extremely accurate because they might have to follow a web without adding any tension to it. So, many of our tolerances are getting tighter, and we need controls that can handle them. Still, if an HMI can handle 10 I/O points, then we still might not need a PLC."

Founded in 1874 in Scotland, W.R. Stewarts started out manufacturing and repairing pinned hackles and staves for the jute, flax and hemp industries. In 1976, it joined forces with an American company and moved to the U.S. to support its booming textile industry. It was bought out by its present owners in

1999, and continues as a separate entity. While it still specializes in perforating and pinned products, it has also diversified into many other industries, including packaging, food, composites, aerospace and automotive. The firm also supports international markets with partnerships in Europe and India, and a solid network of agents worldwide for local customer support. It ships machines and parts to other machine builders and end users in more than 50 countries.

> "Because of the recent economic downturn, many of our competitors make cookie-cutter machines in just a few, inflexible sizes. That's something we refused to do."

"Our expansion into international markets started a bit earlier, but in the past 10 years we've also diversified our perforation and pin technologies into packaging, food and construction products," Jackson adds. "We think our history of customizing so many individual projects is what gives us the ability to push the envelope in new technical areas.

"For example, back in the day, a density of 300 and 600 pins per square inch was considered high density, but now we're up to 5,000 pins per square inch for some applications. So when a user requires any type of perforation, we have the expertise to assist them, no matter how unorthodox their project is. From plastic films to chickens, from foils for NASA to salmon patties and pizzas, we can develop a perforating solution for them. In fact, we just finished a precision perforating unit for making composite material more breathable on the fuselage of the Virgin Galactic aircraft.

"Most recently, we've been working on a pistachio-picking application. We're trying to develop rollers that can pick up on the split in the shell that almost all the nuts develop when they're ripe, and eliminate the need for hand sorting. But, even as we get into these new and unexpected areas, we're still working with some of our original OEMs in Europe and South America on equipment with expanded capabilities to improve quality and speed for processing textile fibers. Either way, we're going to continue to stay on the brink, and continue push that envelope." CD

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Manufacturing Sector Numbers Move Up Slowly

ECONOMIC ACTIVITY IN the manufacturing sector expanded in December for the seventh consecutive month, and the overall economy grew for the 55th consecutive month, say the nation's supply executives in the latest Manufacturing ISM Report on Business.

The report was issued by Bradley Holcomb, CPSM, CPSD, chair of the Institute for Supply Management's (www.ism.ws) Manufacturing Business Survey Committee. "The [Purchasing Manager's Index] PMI registered 57%, the second highest reading for the year, just 0.3 of a percentage point below November's reading of 57.3%. The New Orders Index increased in December by 0.6 of a percentage point to 64.2%, which is its highest reading since April 2010 when it registered 65.1%. The Employment Index registered 56.9%, an increase of 0.4% compared to November's reading of 56.5%. December's employment reading is the highest since June 2011 when the Employment Index registered 59%. Comments from the panel generally reflect a solid final month of the year, capping off the second half of 2013, which was characterized by continuous growth and momentum in manufacturing."

Of the 18 manufacturing industries, 13 are reporting growth in December in the following order: Furniture & Related Products; Plastics & Rubber Products; Textile Mills; Apparel, Leather & Allied Products; Computer & Electronic Products; Paper Products; Transportation Equipment; Primary Metals; Fabricated Metal Products; Wood Products; Printing & Related Support Activities; Food, Beverage & Tobacco Products; and Miscellaneous Manufacturing. The four industries reporting contraction in December are Nonmetallic Mineral Products; Machinery; Chemical Products; and Electrical Equipment, Appliances & Components.

MANUFACTURING AT A GLANCE
DECEMBER 2013

Index	Series Index Dec	Series Index Nov	Percentage Point Change	Direction	Rate of Change	Trend* (Months)
PMI	57.0	57.3	-0.3	Growing	Slower	7
New Orders	64.2	63.6	+0.6	Growing	Faster	7
Production	62.2	62.8	-0.6	Growing	Slower	7
Employment	56.9	56.5	+0.4	Growing	Faster	6
Supplier Deliveries	54.7	53.2	+1.5	Slowing	Faster	6
Inventories	47.0	50.5	-3.5	Contracting	From Growing	1
Customers' Inventories	47.5	45.0	+2.5	Too Low	Slower	25
Prices	53.5	52.5	+1.0	Increasing	Faster	5
Backlog of Orders	51.5	54.0	-2.5	Growing	Slower	3
Exports	55.0	59.5	-4.5	Growing	Slower	13
Imports	55.0	55.0	0.0	Growing	Same	11
OVERALL ECONOMY				Growing	Slower	55
Manufacturing Sector				Growing	Slower	7

INSTITUTE FOR SUPPLY MANAGEMENT

A SOMEWHAT MIXED BAG

Supplier deliveries and inventories were the dark clouds in the December PMI report. Deliveries slower and inventories contracted, while all other categories showed modest growth.

NOTEWORTHY

Toshiba Int'l (www.toshiba.com/tic) formed two new divisions, the Motors & Adjustable Speed Drives Division and the Power Electronics Division, which includes UPS, SCiB rapid recharge battery and power conditioning businesses.

Norgren (www.norgren.com/us) expanded its distribution agreement with Scott Industrial Systems (www.scottindustrialsystems.com) to supply Norgren branded components and solutions in Ohio, Indiana, Kentucky, West Virginia, Tennessee and western Pennsylvania.

Kinetic Machine Development (www.kineticmd.com), a custom machinery designer and builder, opened a regional design and build facility in Rochester, N.Y.

Machinery Directive Harmonizes Standards

A REVISED LIST of Machinery Directive Harmonized Standards was published in the Official Journal of the European Union (OJ) late last year. These harmonized standards provide a presumption of conformity to the Machinery Directive 2006/42. The latest complete list can be downloaded from the European Commission website (http://bit.ly/1j3oiEx, 2MB PDF). This new list of standards, which have been harmonized to the Machinery Directive, supersedes all previous versions. For the first time, the list divides the standards into A-type standards, B-type standards (but not B1 and B2 types) and C-type standards, with an explanation provided for each of the three types.

According to the EU Web site (http://bit.ly/1j3qbRR), "A harmonized standard is a European standard elaborated on the basis of a request from the European Commission to a recognized European standards organization to develop a European standard that provides solutions for compliance with a legal provision. Such a request provides guidelines that requested standards must respect to meet the essential requirements or other provisions of relevant European Union harmonization legislation. Compliance provides a presumption of conformity with the corresponding requirements of harmonization legislation. Manufacturers, other economic operators or conformity assessment bodies can use harmonized standards to demonstrate that products, services or processes comply with relevant EU legislation.

The use of these standards remains voluntary.

CONTROL DESIGN INFOGRAPHIC

Usage and Application Trends in Motion, Drives and Motor Technology

	Most Important	Important	Not Important
Torque Control	32%	55%	13%
Position Control	68%	22%	10%
Speed Control	43%	48%	8%
Line Energy Regeneration	10%	41%	49%

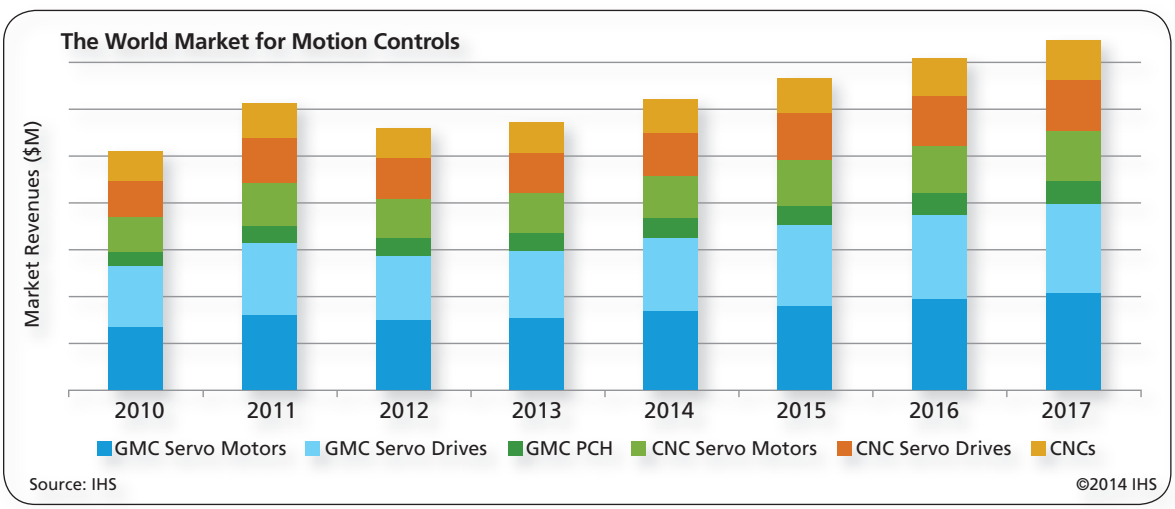
In our most recent survey *Control Design* readers identified what performance characteristics of their drive systems were most important.

Motion Control Market Revenues Fall Short in 2013

GLOBAL SALES OF motion control products recovered in 2013 to exceed $12 billion, but growth was far too weak to overcome the 2012 market declines, leaving market revenues well below the peak level reached in 2011. According to the latest IHS study on the market for motion controls (www.ihs.com), strong growth is forecast to return to the market in 2014, propelling market revenues to a new record high by the end of the year.

The motion control market reached a record level above $13 billion in 2011 following two years of market growth in excess of 20%. In 2012, the motion-control market suffered from the poor economic situation in the Eurozone, a weak semiconductor market in Japan and the fallout from overproduction in China. Market revenues declined in all three of these regions, and the global motion-control market decreased by more than 8%. Conversely, the American market provided a bright spot for motion controls, growing more than 5% in 2012.

When final, the results for 2013 are expected to reveal



IN RECOVERY

Following a rocky 2012, the global motion-control market is recovering, with modest growth for 2013 and even stronger numbers in 2014 and beyond predicted.

another year of subdued growth. Stable industries such as packaging, materials handling, and food, beverage and tobacco continue to propel growth in machinery production and correspondingly, the motion-control market. However, motion-control sales have been constrained in 2013 by the market's dependence on volatile industries like semiconductor, machine tools and robotics, which are known for their cyclic growth patterns. Large declines in these industries in 2009 contributed significantly to the severe decline in the motion-control market that year, and high growth in these industries in 2010 and 2011 boosted the post-recession recovery of the motion-control market.

In 2013, machinery production declined at the global level for the semiconductor and robotics industries and grew very little in the machine tool industry, according to the latest research from IHS on machinery production. Combined, these three industries account for approximately 50% of revenues in the motion-control market, while the more stable industries like packaging, materials handling, and food and beverage account for only about 16% of market revenues. Still, the motion-control market is estimated to have grown by 1.8% in 2013, as small declines in the machine tools and semiconductor machinery sectors were offset by growth in the rest of the motion-control market.

The outlook for 2014 is more optimistic. In the Eurozone, GDP growth is expected to accelerate, and renewed confidence should spur investment in machinery upgrades, leading to an increase in motion control sales.

In the Americas, recovery of the semiconductor machinery market will boost growth of motion control revenues in 2014, while in Asia, the machine tool market is forecast to recover. Globally, the motion-control market is forecast to grow by over 8% to reach $13.3 billion in 2014, exceeding the 2011 record value by 0.6%. CI

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Free Trade and the Small Manufacturer

YOU PROBABLY HAVEN'T heard of the TPP, which stands for the Trans-Pacific Partnership (www.ustr.gov/tpp). It was formed in 2005 and amended in August 2013 to include 12 countries, including the U.S., Canada and Mexico.

The general intent of the agreement is to widen markets, allow access to global markets in a free-trade environment and, most importantly, protect those ideas and processes from any form of theft. Well, if you believe the politicians. There's more under the hood.

The list of opponents is long, and if TPP is instituted, many fear its IP regime could trample individual and corporate rights and free expression, as well as ride roughshod over the intellectual and creative commons.

Free-trade agreements have been in place for a while. Some would argue that the Mexico-U.S.-Canada free-trade agreement (NAFTA) created a dangerous precedent in the domestic economy. For me, history has shown that those concerns were warranted.

A possible thread to this TPP issue is that the U.S. GDP calculations were changed in late July by the Bureau of Economic Analysis (BEA). I'm not an economist, but rearranging the deck chairs to provide a different view doesn't change any of the fundamentals. The changes were made to give a better perception to the growth of the domestic economy. Could there be political motivations? Part of the biggest change is the inclusion of "intellectual property products," which includes R&D and software.

GDP provides an indication of business activity, relative worker wealth and general economic strength. It can be a benchmark for overall confidence. A bigger number suggests that business is booming. Including the new IP components in the GDP will give the impression that all is good; you can hire and create jobs.

Higher GDP numbers also influence global investment in that country. It's widely thought that this new GDP calculation will give the U.S. more clout in TPP negotiations.

There's good reason to think that North American innovation might now be protected in some manner by TPP. There is a section in the TPP called Industrial Designs. While short, its purpose is to protect the designs of manufacturing. Machine design, components of automation and processes would have some protection. At least on paper they would.

There have been stories of U.S. machine builders providing full engineering drawings along with the machine to an offshore customer, only to find out later that the customer reversed-engineered it and now builds and sells the machine itself. This practice might be disallowed under the TPP rules.

That protection sounds good, but the global economy is real, and somehow we have to adapt to this changing tide, along with understanding the global effects of politics and legalities.

We never had to do that. We just designed, innovated, built, supplied and consumed. We hired people, paid them well, and everything was wonderful.

The new world is influenced by social, political and legal differences. For smaller companies, these could be debilitating. The seeming protection of U.S. big business could create an unfair playing field for the small guys. The only ever-present groups who support the current negotiations are large U.S. corporations and Wall Street, so this can't be good for smaller, competing companies, right?

When I did the research for my recent presentation at the ISA Automation Week Conference, every metric that dealt with jobs, employment and business growth in our sector(s) did not agree with the overall perception that the economy is busting loose.

■ There's good reason to think that North American innovation might now be protected in some manner by TPP. ■

According to census.gov, most areas of the economy are at 40 to 60% utilization and have been for some time. Some of the increases simply might have been a result of inventory replenishment. Of course, a major concern has been the slow speed at which anything has happened.

I'm concerned that the risk to the well-being of smaller North American manufacturers might be the most troubling possibility in all this if the IP and innovation rights of U.S. companies are truly protected in all these other countries. No longer fearing for their IP rights, would large companies think again about moving operations to countries with lower wages and more-lenient regulation? Could this re-ignite outsourcing?

We need to understand more about the TPP. CD

JEREMY POLLARD, CET, has been writing about technology and software issues for many years. Pollard has been involved in control system programming and training for more than 25 years.

See the Difference

Robots Paired With Machine Vision Create Automated and Efficient Motion, Leaving the Old Generation Behind

by Dan Hebert, PE,
senior technical editor

ROBOTIC CAKE DECORATOR

Concept Systems (www.conceptsystemsinc.com) in Albany, Ore., provides integration services and automation products to machine builder OEMs. These systems typically consist of robotic workcells with integrated machine vision and 3-D laser scanning.

Doug Taylor, project engineer at Concept Systems, describes how a robot with vision is being used to decorate cakes, saying, "We supplied a 3-D vision system retrofit for a pair of robotic cake decorating lines for a large bakery, replacing a 2-D camera system that only provided the center point of the cake (X-Y), but offered no Z-axis information whatsoever," Taylor adds.

The new system scans cakes as they are conveyed into the robotic work cell and generates a 3-D model. "The model is used to generate a unique path for the robot to decorate the cake," Taylor adds. "It is a recipe-driven system, so the same robot can decorate many different cake styles with minimal changeover interactions."

The new system uses Hermary SL1880 scanners (two scanners and two robots per line) tied to a workstation PC communicating to the robot via an Ethernet connection. The four robots are Fanuc PCDK models.

"A Dell Alienware laptop PC on each line runs custom code written in Visual Studio 2012 which

Robots have been used for decades in industrial manufacturing applications to perform tasks such as welding, part picking and metal working. But without vision systems to guide robot movements and actions, these applications were limited to performing the same or very similar operations over and over on precisely located parts.

Consider an application where five similar, but not identical, sets of parts need to be welded. Without a vision system, five robot stations are required. Each part must be mounted in a costly high-precision fixture manually and then welded by a tool attached to a robot arm that moves with high accuracy and absolute repeatability.

When a vision system is paired with a robot, one welding station can weld all five part types, as well as other parts. Each part doesn't need to be manually and precisely mounted, but instead just needs to be securely attached to a servo-driven housing, with the vision system aligning the parts as required.

Vision systems free robots from the narrow restrictions of time and space, providing a host of advantages in a wide variety of manufacturing applications. These advantages enable more widespread use of robots by guiding their actions to closely fit ever-changing and more-demanding production requirements.

See It, Do It

When a robot can't see, the part on which it will perform an action must be precisely placed, requiring a very accurate fixture or positioning system and a high-precision robot. But with vision, close is good enough, as the robot can find its own way. "Vision systems make it possible to use a less precise and expensive robot for precise placement applications such as wafer alignment, part orientation or part presence," says Bob Fung, vice-president of engineering at Owens Design (www.owensdesign.com), Fremont, Calif., an automation services company that creates, designs and builds equipment for the semiconductor, disk drive, solar, flat-panel, LED, fuel cell and mobile electronics markets.

Chris White, project manager for automation at CMD (www.cmd-corp.com), Appleton, Wis., agrees. CMD built an automated packaging system based on a Yamaha robot and vision system that eliminates most of the problems with fixtures, part-positioning, orientation, part defects and product changeovers. "The vision system provides the robot with the position and orientation of the part, allowing the robot to pick and place the product as desired," he explains.

Matt Wicks, vice president of product development at Intelligrated, Mason, Ohio, (www.intelligrated.com), a materials handling specialist, says his company uses vision in applications when the material handling operations require more understanding about the environment, material or products. "We recently demonstrated a robotic de-palletizing application (Figure 1) that used 2-D and 3-D vision to determine the location and orientation of cases stacked on a pallet," Wicks says. "Then the robot was commanded to de-palletize the products onto a takeaway conveyor. This type of operation wouldn't be possible without the use of vision-guided robotics."

In some instances, seeing the parts and performing actions could be performed by sensors, but cameras are often a better solution. "As the price of vision systems drops, they're replacing sensors as they provide more functionality and flexibility," Fung adds. "For example, in the past we had to use multiple sensors or move the product past the sensors to determine the quantity and

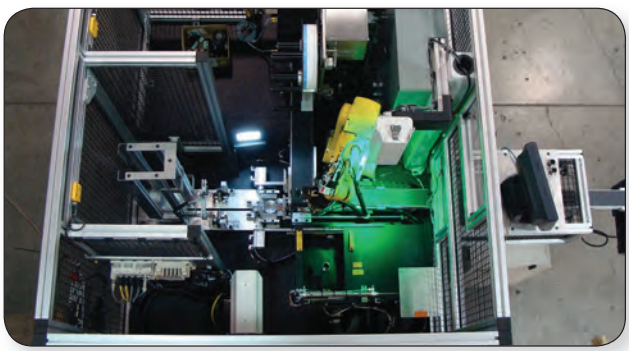
accesses the Fanuc PCDKs directly in .net code," Taylor explains. "The PC is the HMI, and it talks to the robots using the robot libraries. All four robots run Fanuc handling tool software, and the program is written in the TPP language."

Two separate but identical lines were retrofitted, allowing the bakery to process up to 40 cakes per minute. Taylor says the new system expanded the product offerings, increased the cake height envelope from plus or minus an eighth of an inch to plus or minus 5 inches, and increased overall throughput.

"We are expanding the system to include new R&D cake decoration designs," Taylor says. "The bakery sees the new 3-D scanner systems as a competitive advantage that will allow them to compete for work with a higher repeatability in the decorations at a much more competitive price point than they have been able to offer in the past."

orientation of parts in a carrier. A single camera now can do the same without moving the part, and it can support product changes without changing hardware."

A bakery used a 2-D vision system to guide cake-decorating robots until about a year ago. It upgraded to 3-D to improve flexibility and increase throughput. (See the "Robotic Cake Decorator" sidebar, p24.)



INTELLIGRATED

COST MAKES VISION LOOK BETTER

FIGURE 1: Vision is becoming a more viable option due to advances in software and hardware along with a corresponding drop in costs, making it more prevalent in applications like this layer de-palletizer.

How Hard Is It?

Adding vision to a robot isn't always easy. "There are challenges with the seamless integration of sophisticated vision, robotics and the accompanying automation systems," Wicks says. "This advanced level of integration requires a collaborative effort on the part of the vision systems providers, robotic arm manufacturers and robotic systems integrators because it requires in-depth knowledge of not only the vision piece, but also how it integrates with the robot and other automation equipment."

Fung says that most vision systems must be designed specifically to meet the requirements of the tool into which they are to be incorporated. "This increases the overall tool cost as well as the design time," he explains. "There's a lack of generic, industrial-quality vision systems that can be programmed easily to meet a variety of system requirements. Most vision systems are difficult and complex to operate. Much of the system complexity is due to the high image quality required for most applications, as well as challenges involved in accurately measuring parts that don't conform to regular shapes."

"While the software has become increasingly user-friendly, end users still need some proficiency with programming and setting up the cameras when they introduce a new product. Depending on the type of features the customer is looking for, this can be a tedious process."

Software and lighting pose problems, too. "We've seen advances in both software and lighting for vision systems, but there are many opportunities for further improvement," CMD's White says. "While the software has become increasingly user-friendly, end users still need some proficiency with programming and setting up the cameras when they introduce a new product. Depending on the type of features the customer is looking for, this can be a tedious process of adjusting the camera and lighting to show the intended features. Products have different patterns, colors, sheens and materials that can complicate setup."

Fung agrees and suggests improvements. "Lighting systems must be able to fit into the tool without adding excessively to tool size," he says. "Designers usually have to use very thin, industrial-grade backlighting, which is expensive and further increases overall system cost. Filtering to prevent stray light reflection is also a concern."

Most robot and vision vendors recognize the integration challenges and provide solutions. For example, White explains how Yamaha software helps, saying, "The software program in the Yamaha RCX controller is a modified form of BASIC. The commands are actually quite simple. For instance, a MOVEP command (move to position) tells the robot to move to a given X,Y,Z coordinate. The Yamaha firmware and hardware determine the most efficient path and control all the

ADVANTAGES OF USING VISION TO GUIDE ROBOTS

1. Automates manual steps and processes
2. One camera can replace multiple sensors
3. Speeds production and increases throughput
4. Greatly reduces programming effort to guide robot
5. Increases flexibility of the robot
6. Recipe-driven production reduces changeover times
7. Allows for less-precise positioning of parts
8. Less-expensive and more-precise robots can be used
9. Eliminates expensive fixtures
10. Allows a robot to perform multiple tasks

INTEGRATED VERSUS SEPARATE

Many robots can be purchased with built-in and tightly integrated vision systems, a departure from times past when OEMs had to buy the robot and the vision system separately and perform the integration. Both approaches have merits and drawbacks, depending on the specific application.

"We are currently working on a new and improved vision system that will be purchased separately from the robot vendor and then integrated by CMD," says Chris White, project manager for automation at CMD (www.cmd-corp.com). "A PPT Vision camera system will provide increased functionality at reduced cost for our applications. The new system also will be simpler to program and more interactive with the user."

Integrated vision systems often are mounted directly on a robot, which can cause a problem, according to Doug Taylor of Concept Systems (www.conceptsystemsinc.com). "2-D machine vision systems all calibrate from a fixed camera position. When you mount the camera on the robot, the system becomes very difficult to integrate because the fixed calibration really needs an affine transform using the robot position to remain in calibration to the robot coordinates. Currently, no vision library provides this affine transformation in a ready-to-use manner."

[Editor's note: An affine transformation or affine map is a function between affine spaces which preserves points, straight lines and planes. Also, sets of parallel lines remain parallel after an affine transformation. An affine transformation does not necessarily preserve angles between lines or distances between points, though it does preserve ratios of distances between points lying on a straight line.]

Tom Spisak of Automated Cells & Equipment (www.autocells.com) points out other drawbacks to integrated vision/robot systems. "Components and package pricing are higher," he says. "They use expensive, high-flex cables, and we've seen occasional delivery problems, especially for special items."

But some use integrated vision system to great success. "Epson's vision system was developed specifically to work with its robots," explains Cale Harbour, product manager at distributor and integrator Advanced Control Solutions (ACS, www.advancedcontrolinc.com) "It uses a remote camera head tied to its CV1 vision controller. The Epson robot controller talks seamlessly to this unit and communicates via EtherNet/IP with the main PLC running the machine."

An integrated robot/vision system will be more expensive up-front, but it can be applied with less engineering effort. For those with extensive in-house integration expertise, separates are often a better solution.

motors to arrive at the destination as smoothly as possible and within the defined limits."

Steve Zhu, director of business development for Teledyne Dalsa (www.teledynedalsa.com/corp), describes a system the company built at a Honda plant that also uses vendor software to advantage. "Our GEVA1000 vision system and Sherlock software is being used for China's Dongfeng Honda Assembly line, where an ABB robotic gripper is used to grip the car body accurately and reliably (Figure 2). Our GEVA1000 with Sherlock guides the giant ABB robot to locate the car body properly."

Sherlock software tells the robot where to go. "With its search tool, the software can recognize marks and locate the right positions where the grippers should be put on car bodies of different sizes," Zhu says.

"Low-cost sensors such as the Microsoft Kinect and the recently released Kinect 2.0 provide powerful vision data that can be leveraged by sophisticated software to yield impressive results."

HMI software vendors also provide assistance with robots and vision. "The volume of data produced by vision systems operating at high speed can't be handled by most database servers, and specialized data historians may be required just to capture the data stream," says Fabio Terezinho, vice president of consulting services at InduSoft (www.indusoft.com). "The OEM's vision system uses our HMI capabilities to show and ameliorate volumes of complex, high-speed data, especially in a quality assurance (QA) application where parts are inspected by the high-speed vision system at 10 msec intervals."

Some of the integration problems can be eliminated by using a robot with a vision system supplied by the robot manufacturer (Figure 3). "We use Fanuc robots with their integrated iRVision, so we no longer purchase many third-party vision systems, says Tom Spisak, senior controls engineer at integrator Automated Cells & Equipment (www.autocells.com), Painted Post, N.Y. "Before iRVision, we purchased Cognex cameras and integrated them into the robot cells." Why the change? "Faster integration and easier support from a single manufacturer, which translates into lower costs and increased performance," Spisak says.

If buying an integrated robot and vision system makes everything so easy, you might expect this to be the Next Big Thing in robotics, but there are drawbacks to this approach. (See the sidebar, "Integrated Versus Separate," p28, for more on this topic.)

Peering into the Future

Although vision systems are used extensively in various industrial applications, there's room for much more growth if certain improvements can be made. "When it comes to vision system hardware, cost is always an important issue—that is, getting a camera and lens with the resolution and depth-of-field required for the application at an acceptable cost," Fung says. "All too frequently design engineers are forced to compromise between image quality and system cost."

So how about an ultra-cheap vision sensor backed up by gaming software? Intelligrated's Wicks reveals that the vision system his company used in the robot depalletizing application described above is a Microsoft Kinect—the same $150 sensor used in the Xbox video game. "Low-cost sensors such as the Microsoft Kinect and the recently released Kinect 2.0 provide powerful vision data that can be leveraged by sophisticated software to yield impressive results," Wicks claims.

No one was more surprised than Microsoft when

TELEDYNE

PICK-UP ARTIST

FIGURE 2: A vision system tells the ABB robot where to go to pick up car bodies at Honda's plant in China.

robot experts started adopting the Kinect. An article in *Wired* magazine (www.wired.com/magazine/2011/06/mf_kinect) reports, "…the company's official response to all this activity has gone from hostility to acceptance to vigorous support… The company is also granting access to the high-powered algorithms that help the machine recognize individual bodies and track motion, unleashing the kind of power that was previously available to only a small group of PhDs."

Microsoft might emerge as a major competitor,

"Smart machines are the dawn of a new era, wherein integrated vision, sensor and control loops are established to drive repeatable and accurate performance across semi-complex and complex job routines."

especially if robot and vision vendors don't improve their software. "Easy-to-use software will bring the barrier down to many users and operators who are interested in using vision for their automation and robots," Zhu says.

Vision and robot systems also need easier communications. But this is happening as various suppliers recognize the need. Marc Wolf, business development manager at B&R Industrial Automation (www.br-automation.com), says Pro Pack Systems (www.propacksystems.com) in Salinas, Calif., one of its machine OEMs, uses vision to detect position and orientation of incoming product, as well as to sort different products. Pro Pack connects the robot and vision system using Powerlink, and programs it with B&R Automation Studio Software. "Vision over Powerlink enables Pro Pack to use a single network and single PC for the control system logic, vision and motion control," Wolf says.

"Smart machines are the dawn of a new era, wherein integrated vision, sensor and control loops are established to drive repeatable and accurate performance across semi-complex and complex job routines," believes Muthuraman Ramasamy, industry manager at Frost & Sullivan (www.frost.com). "There is ongoing activity in universities to enhance the quality of image processing by allowing the robot to understand shapes and geometries in ways that were not possible before."

Industry needs combined with hardware and software advances promise to increase the penetration of vision-guided robots, delivering a host of operational advantages at ever-decreasing costs, with improved performance and ease of use. CD

LASER VISION

AUTOMATED CELLS

FIGURE 3: An integrated robot/vision system allows an overhead camera on this laser engraver/labeler to find the part for the robot so that it can be picked up and placed in front of the laser engraver.

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Machine Builder Provides Vision System That Can Handle Three Parts Per Second With 99.97% Accuracy. Its Name Is "Vision System."

by Brian Altman, Altman Manufacturing

VIRTUALLY EVERY MANUFACTURER recognizes the role that quality plays in establishing lasting, trusted relationships with its customers—an essential element that helps enhance its growth and long-term stability. Ensuring that level of quality, particularly in long-run, difficult-to-automate, component manufacturing and assembly operations often could be a daunting task, for which the only solution was throwing people at it.

For a long time, these manufacturers had to rely almost entirely on the manual inspection of these components. For an equally long time, machine vision inspection systems were costly, limited in capability and had uniquely developed software that was very difficult to configure, use or modify.

Now, as amazing as the human eye is, it's unreliable in repetitive work, especially when the work involves judging slight differences in size. To avoid the mistakes that workers are bound to make from time to time, most manufacturers today will rely on automation for their quality checks whenever they can.

A typical inspector is 92% effective during the first hour and 80% effective thereafter. This forces many companies to implement a process in which inspections are staggered and the same part is inspected multiple times by different inspectors, increasing inspection cost.

Dare to Do the Difficult

Established in 1942 and headquartered in Lisle, Ill., Altman Manufacturing is a family-owned manufacturer of automation, fabrication and tool-and-die-cutting machinery that specializes in developing equipment and processes to mechanize and finish hard-to-automate products, including rubber and plastic goods without a defined geometry.

About three years ago, a customer that manufactures Elastomer rubber components for use in the medical industry approached Altman Manufacturing to develop a machine that it could use to automate its process to inspect finished products.

"To illustrate their challenge, our customer brought us three different products they produced: a seal, an item similar to an O-ring and a filter/seal combination," explains Paul Altman, Jr., who leads engineering at Altman Manufacturing. "While they were made of the same silicone material, the three products were different sizes, shapes and colors, and the filter, in particular, had holes that could easily be filled with excess silicone or flash during the manufacturing process. The customer wanted a system that would inspect these different parts, and also could scale to inspect any new parts they manufactured in the future."

While defective parts can be detected during manual inspections, the fact that any defective part might make it to assembly posed challenges for the customer, who could be back billed for any product that didn't work as promised.

The time and labor required to inspect products using the customer's existing manual system were costly; inspections were completed by workers who sat at inspection tables and manually checked the small parts—some of which were less than an inch in diameter—as they moved down a conveyor. Even the most efficient operator was only 87% effective, and because the manual inspection process was time-consuming and tedious, the effectiveness of the inspections often diminished in the last hours of each shift.

In fact, a typical inspector is 92% effective during the first hour and 80% effective thereafter. This forces many companies to implement a process in which inspections are staggered, and the same part is inspected multiple times by different inspectors, increasing inspection cost.

If a defective product is found, it could be reworked in the case of flash or overmold, or it might be discarded, for example, if it had a hole.

Seeing the "Proof"

The company has worked with virtually all providers of vision inspection systems, and Altman knew almost immediately which vision system would be the most effective for this application. "We choose the vision system that is best for the application, and what makes Teledyne Dalsa [www.teledynedalsa.com] ideal for inspecting Elastomer rubber products are the company's unique algorithms, such as 'contour,' which is perfect for checking the edges of a rubber piece," Altman explains. "Teledyne Dalsa also provides the flexibility to turn certain features, such as the area calculator, on and off as needed. For general inspections and finding flash, and because of the product's easy-to-use drag-and-drop functionality, we think this is the best vision system for this application."

However, before any system is put into production, Altman evaluates the parts using a sample system for pre-production inspection that was developed with Teledyne Dalsa. Using the sample inspection system allows him to view different parts, and design appropriate lighting to ensure the camera delivers the optimum results. "We use this pre-production process to create a customer presentation that illustrates how a product could be inspected given the technology available," Altman explains. "In production it points to the defect, describes how it was found and the algorithm we used, and explains how a defective part would be sorted. We can show customers how effective a solution will be before they order the machine, similar to a proof of concept. This ability is especially important when developing a vision system. Until we have a lighting scheme and know which lens will be used, we can't be sure if a solution will function as we expect. Working with Teledyne Dalsa to show customers difficult applications ahead of time has been very important to our business. Customers understand in advance what a vision system will do and how it will work, so there is no 'vision creep,' that is, future requests for inspections beyond the capabilities of a machine."

Right Light, Right Camera, Right View

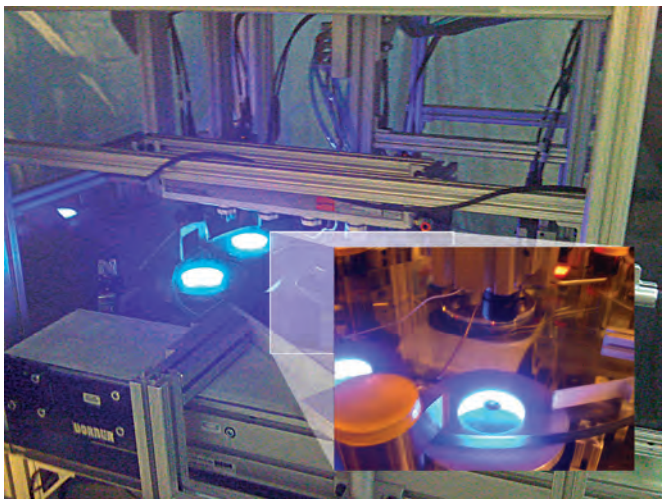
The machine Altman built for the medical-component manufacturer (Figure 1) uses Teledyne Dalsa's GEVA Vision Appliance, eight Genie high-resolution 1600 cameras and iNspect vision application software. The system is set in advance based on which parts are to be inspected, specific lighting schemes and camera zones that are developed for each unique part. For example, one part might require inspection using an overhead light, while another might need an under light, and a third could require a dark-field inspection. Each part and lighting scheme is also associated with a particular field of view, so one part will be inspected with cameras one, two and three, but a second part will be inspected with cameras one, four and six. To simplify an otherwise complex process, cameras are set so that no elaborate focus techniques are required.

> "Eliminating manual inspections alone has led to a significant return on investment, and the speed and accuracy of the new equipment has increased productivity rates overall. Plus, we've demonstrated that the solution can scale to meet all their future demands."

ALTMAN

CUSTOM INSPECTION

Figure 1: The inspection machine built for the medical-component manufacturer has eight high-resolution cameras and vision-application software. The system is set in advance based on which parts are to be inspected, and specific lighting schemes and camera zones are developed for each unique part.



ALTMAN

DOUBLE-CHECKED

Figure 2: The machine orients each part so that it moves under Camera One, which checks that the correct part is presented properly. As a part moves down the conveyor, it crosses on to a glass disk, and is viewed under the appropriate lighting scheme and with the designated camera regime.

Since the machine can accommodate multiple parts, the parts are hand-fed by an operator, who places them on the belt. The machine then orients each part so that it moves under Camera One, which checks that the correct part is presented properly. As a part moves down the conveyor, it crosses on to a glass disk, and is viewed under the appropriate lighting scheme and with the designated camera regime (Figure 2). Images are then inspected using Teledyne Dalsa's iNspect software. If a part doesn't meet the pre-set requirements, it's discarded. The image of the defective part is stored so that the defect can be tracked, and a counter identifies into which bin the part was sorted and why.

The vision system is integrated with other elements of the production process by an Ethernet connection. As data is compiled, operators can be notified quickly if the number of discarded parts meets a preset threshold, which might indicate an issue in the manufacturing process.

Parts that pass inspection are sent on to packaging or shipping. The customer produces only Elastomer rubber components, so finished parts are sent to a different facility for assembly.

"With this automated inspection system, our customer inspects more than 100,000 of the same type of part in each run and transitions seamlessly from part to part, inspecting as many as 20 different

"We provide the original 'recipe' and back-end script, so there is no need for an operator to have the expertise to write code. A user can easily switch from part to part or create a scheme to inspect a new part using a previously scripted 'blank' menu item and the drag-and-drop algorithms."

parts in a day," Altman notes. "Thanks to the efficacy of this vision system, the machine can inspect three parts per second with 99.97% accuracy, a rate of speed and accuracy that was unimaginable before." Altman is quick to add, however, that the real value of the vision system goes beyond the percentages: The most important consideration is whether or not the customer is able to identify as many defective parts as possible based on the algorithms and criteria they've defined.

Altman credits Teledyne Dalsa's GEVA Vision Appliance with ensuring the scalability of the solution. "The GEVA Vision Appliance enables the solution to be completely adaptable," he says. "We can incorporate eight different cameras for eight unique fields of view, but then choose which ones will turn on and when for a completely flexible implementation." Even given the complexity of the solution overall, Altman notes that the iNspect vision application software simplified the design and deployment of the automated inspection process. "Customers do not have to be technically skilled to use it," he says. "The software works with real-world dimensions and drag-and-drop algorithms for an easy-to-use operator interface. We provide the original 'recipe' and back-end script, so there is no need for an operator to have the expertise to write code. A user can easily switch from part to part, or create a scheme to inspect a new part using a previously scripted 'blank' menu item and the drag-and-drop algorithms."

In fact, Altman says that while training for other types of programs could take weeks, the training for iNspect was completed in just over a day, and he was able to deliver a level of training that ensured that the operator he trained could train someone else.

In addition, the vision system requires minimal maintenance, just periodic cleaning of the lenses and optics. But if additional support is needed, the customer can reach out to either Altman or Teledyne Dalsa.

"With this automated inspection system, our customer inspects more than 100,000 of the same type of part in each run and transitions seamlessly from part to part, inspecting as many as 20 different parts in a day. Thanks to the efficacy of this vision system, the machine can inspect three parts per second with 99.97% accuracy, a rate of speed and accuracy unimaginable before."

Flexibility for the Future

Altman never had any doubt that the Teledyne Dalsa solution was ideal for this application, but his confidence was proven again after the equipment had been in operation for more than two years. "This vision system was ideal in that it allowed us to incorporate multiple cameras and gave us the ability to control them with easy-to-use software," he notes. "Recently, the customer needed to inspect a completely different and unique part, a slit in a Duckbill (check valve), and they were able to set up the appropriate lighting scheme and fields of view on their own—without any help from me. They're highly satisfied with the solution, and the results are proven. Eliminating manual inspections alone has led to a significant return on investment, and the speed and accuracy of the new equipment has increased productivity rates overall. Plus, we've demonstrated that the solution can scale to meet all their future demands." CD

BRIAN ALTMAN is vice president of sales and marketing at Altman Manufacturing. Learn more about the company at www.altmanmfg.com.

Drives Integrate, Gain Intelligence

MOTORS AND ELECTRONIC drives have gone thorough many evolutions in recent years, but these advances in networking, integration, intelligence, diagnostics and analysis have a common purpose—to improve end users' machines and applications. Five or six years ago, for example, electronic drives for industrial servo systems began to move out of their control cabinets to get closer to their motors, according to Reid Hunt, product manager for drives and controls at Kollmorgen (www.kollmorgen.com).

"Especially on long or big machines with multiple cabinets and cables, it can save time and hardware and improve reliability to have an integrated motor and drive," Hunt explains. "However, while physically combining can make it hard to exhaust heat and maintain performance, integrating them with a hybrid cable can solve this problem. We just launched a decentralized servo system that links drive and motor with an eight-wire, 11-mm-diameter, composite cable that can be 0.5 to 5 m long, and lets us mount a drive close to its motor on the same machine chassis. A second, 11-mm cable lets drives be daisy-chained and run motion buses such as EtherCAT via power wiring."

Not surprisingly, these increasingly sophisticated ties between drives and motors are accompanied by leaps in intelligence as well. Evan Kaiser, business team lead for compact drives at Rockwell Automation (www.rockwellautomation.com), reports that drives are getting smarter to perform more sophisticated control, operating and communications tasks. "In the past 10 years, drives added devices and architectures that ease commissioning, improve diagnostics and put software building blocks at users' fingertips to give them predictive, post-event maintenance and safety functions," Kaiser says. "This means they can trend live output current from a drive, see bearing problems earlier, find issues sooner in a motor control center managing hundreds of drives, or use the safety circuits in a drive to replace contactors. Previously, you'd need an external sensor for jobs like these, but now many drives do them automatically, and we can monitor many signatures and trends for our customers."

Following the transition from dc to ac drives over the past 20 years, variable-frequency drive (VFD) and servo users now seek drives that can deliver customized physical and power matches for their applications, according to Craig Nelson, product manager for Sinamics drives at Siemens Industry (www.usa.siemens.com/drives). "More customers want the value of only paying for what they need for the application at hand, but they also require flexibility for their machine designs to keep up with fast-paced trends, and so they apply servos and more axes in decentralized approaches with drives and devices right on motors and machines instead of in centralized cabinets," Nelson explains. "However, these decentralized drives require protection from the environment, so in January, we added our S120M decentralized motor integrated drives to our S120 centralized drive system. S120M reduces cabinet size by integrating the inverter with the servomotor on the machine, and then uses a hybrid cable to reduce multiple cable runs between the cabinet and the machine. For example, if a machine expands from four to six axes, a machine builder can add them to the end of a hybrid cable's daisy chain without worrying about added cable runs and if they'll fit in a cabinet."

■ Following the transition from dc to ac drives, VFD and servo users now seek drives that can deliver customized physical and power matches for their applications. ■

Beyond meeting technological and economic needs, digital servo drives also can reduce energy costs and meet green and sustainable manufacturing efforts, adds Robert Swalley, motors and drives product specialist engineer at Beckhoff Automation (www.beckhoffautomation.com). "As a result, we're also selling more servo amplifiers and terminals, such as our EL7201 servo terminal that we introduced in 2011. It slides into an I/O rack, and can combine with our AM8100 servomotor to run at approximately 200 Watts. Also, it serves in applications that require smaller motors and amplifiers, which in turn cuts more costs.

To futher reduce expenses, Swalley confirms that drives and motors are using One-Cable Technologies (OCT) that combine power and communication in one cable. Beckhoff's larger capacity servo amplifier can operate with one-cable servomotors or traditional two-cable motors. In addition, its I/O modules, terminals, servos and other components are integrated into TwinCAT automation software. "This means users' drive configurations are all taken care of in software," Swalley adds. "This is a big advantage because use of servomotors and drives are going to continuously increase over the next few years." CD

Data: Monitor It and Move It

The Functions Needed in Today's HMIs Had Better Include the Tools to Get the Data Wherever the Machine User Wants It

THE INFLUENCES THAT push HMI/OI design and application work include data-collection needs. "Industry continues to look for better ways to get data in usable forms, so it can be used in other mainstream business software," says John Hughes, vice president–business development at Rice Lake Weighing Systems. "Scale data from process control is valuable for traceability, quality improvement and process monitoring."

Increased automation and simplification of operator interaction has an influence as well, Hughes adds. "This is where the changes in HMI really make a difference," he says. "Directed process intervention is much easier today than in the past. Through visual signals, the operator can easily make decisions about controlling even very complex processes."

Cloud use is influencing this as well. "Is HMI in the cloud a good idea?' asks Ramal Murali, president, Software Horizons. "With all the hype and sex appeal of cloud-based computing, the temptation is 'to cloud'" he says. But he adds, "There are two approaches to remote access to HMI-server. The first is a software as a service (SaaS) implementation with infrastructure (server, database, etc.) in the cloud provided as a subscription to the user. With such a cloud implementation, HMI runtime should be remotely accessible from any Web browser—iPad, iPhone, BlackBerry, laptop PC, etc.—over the Internet."

The second approach, Murali says, is to eliminate the cloud infrastructure by doing a Web server implementation that requires a software product license for an HMI runtime 'Web server' option for installation at a customer site. "Such installation may be on the same platform as the HMI server or another PC on the same LAN as the HMI server. With the Web server implementation, HMI runtime can be remotely accessed from any Web browser (again, iPad, iPhone, BlackBerry, laptop PC, etc.) over the Internet, as well as over the LAN without Internet."

Murali argues that there are perceived customer advantages of Web server over SaaS HMI cloud services: no subscription fees on an on-going basis; the ability of a customer to enforce his own HMI server and Internet access policies, including VPN; no dependence on third-party cloud infrastructure; and a sense of security that data does not leave a company's own hardware infrastructure.

Smaller headcounts make the need for greater mobile access one of the key industry/market trends influencing HMI development, says Fabio Terezinho, vice president of consulting services at InduSoft. "As the cost of handheld devices becomes more affordable, many companies are implementing 'bring your own device' (BYOD) policies that allow employees to use their personal smartphones and tablets for work purposes, driving the HMI market to develop more applications for these types of devices," he explains. "Software packages with HTML5 support dramatically cut development time for mobile device screens, enabling workers to access HMI applications from almost any device. Multi-touch technology better suits the smaller touchscreens, but it also makes executing commands up to three times faster over traditional single-touch screens."

PLC + HMI

Flat-fascia Vision350 supports 24 auto-tuned PID loops, while the 16-bit, 3.5-in., 320 x 240 QVGA color touchscreen displays data, color trend graphs and alarm screens. Internal memory holds 1 MB of application logic, plus 512 KB for fonts and 6 MB for images. It has a variety of onboard and expandable I/O options, and units are capable of supporting up to 512 I/O and include serial, Ethernet and CANbus communications options.

Unitronics, 617/657-6596; www.unitronics.com

OI ANYWHERE

Web-based, mobile, operator interface system groov for operator interfaces on smartphones, tablets and other mobile devices requires no programming to build operator interfaces that can be viewed on almost any mobile device or computer, regardless of its manufacturer, operating system or screen size. System integrators, machine OEMs or any authorized person can securely monitor and control automation systems from Rockwell Automation, Siemens, Schneider Electric, GE and other providers.

Opto 22; 800/321-opto; www.groov.com

HMI + TABLET

HMI-Tablet integrates its visualization display into an iPad to allow the operator full HMI wireless control using multi-touch-enabled Trend Display and Data Display. The HMI-Tablet has powerful connectivity, supporting more than 200 different PLCs, servo drives, inverters, temperature controllers and other devices.
Rohtek Automation; 425/328-8445; www.rohtekautomation.com

HMI + PLC

T1A SmartAxis Touch all-in-one, 3.8-in. touchscreen interface and logic controller includes a built-in RJ45 Ethernet port, and an embedded RS232C/422/485 interface terminal allows communication with other serial devices or Modbus RTUs. A USB mini Type B port allows maintenance communication, and a USB Type A port allows data logging and recipe data. Available in 65K TFT color or STN monochrome display with a screen brightness up to 700 cd/m2.
IDEC; 800/262-4332; www.idec.com/usa

ONE FOR ALL

OmniClient for running real-time control and visualization simultaneously features a wide-screen format with a touch-sensitive, durable, seamless glass front that supports multi-touch operations. Interface options include Wi-Fi, Bluetooth and RFID, and the device is shock- and vibration-resistant, thermally stable, has an IP65 front panel and is EMC-compliant.
Kontron; 858/677-0877; www.kontron.com

ALL IN ONE

CP26xx fanless Panel PC series with ARM Cortex A8 processor has aluminum panel housing with high-quality glass front for IP65 protection at the front and IP20 in the back. Users have a choice of eight multi-touch TFT displays in sizes from 7 to 24 in., with 4:3, wide-screen, landscape or portrait formats. Dynamic multi-touch response works even while wearing thin work gloves.
Beckhoff Automation; 877/twincat; www.beckhoffautomation.com

IT'S A BFD

G3 BFD 38.5 x 19-in. flexible display has an easy-to-read red LED display window and connects directly to the RS485 port of a G3-series HMI. The big, flexible display is designed using 32 display boards in an eight-column by four-row configuration that displays text and graphical information to the entire plant floor.
Omega Engineering; 203/359-1660; www.omega.com

TOUCHABLE

Power Panel T-Series terminals and Power Panel C-Series controllers have touchscreens and an embedded browser. The terminal series has four TFT display sizes ranging from 4.3 to 10.1 in. with two Ethernet interfaces, two USB ports and an array of configuration options. The controller offers three display sizes ranging 5.7 to 10.1 in. They do not have hard disks, fans or batteries, and the panel front provides IP65 protection.
B&R Industrial Automation; 770/772-0400; www.br-automation.com

TWO IN ONE

HMC7070A-M is an all-in-one, 7-in. graphic HMI and PLC. The HMI supports 32,000 colors for clear and vibrant display of bitmaps. The touchscreen is suited to industrial use, and built-in Ethernet, serial and USB ports allow for multiple connectivity and communication scenarios. The device is rated for Class I/Div 2, cULus-, RoHS- and CE-compliance, and is capable of operating in hazardous conditions. The HMC7000 series is programmed with MAPware-7000.
Maple Systems; 425/745-3229; www.maplesystems.com

MONITOR PERFORMANCE

WinCC/PerformanceMonitor package, available with Simatic WinCC V7.2 SCADA software, calculates and analyzes runtime process data. Available visualizations include a Gantt chart with the time sequence of states, a bar chart to analyze key performance indicators and a table for states and accompanying values. The visualizations are also available via the Web in WinCC WebNavigatorClient. The calculated key performance indicators can be further processed in a WinCC display, including line-dashboard or trend displays.
Siemens Industry;800/964-4114; www.usa.siemens.com/wincc

REMOTELY POSSIBLE

GoToMyHMI web server enables remote monitoring and control access to HMI server software running on a Windows PC or CE platform from any browser-enabled device, including iPads, iPhones, smartphones and laptops. It implements an HMI gateway to provide safe, secure and speedy access to HMI information from anywhere to receive critical alarm notifications, including acknowledging alarms and taking corrective actions. Using InstantHMI development tools, it can be configured without making any changes to existing in-plant HMI/SCADA systems.
SoftwareHorizons; 800/664-2000; www.instanthmi.com

WATCH YOUR WEIGHT

The 880 Performance Series panel-mount indicator can be DIN rail-mounted as a stand-alone controller or connected to a vast range of networking protocols and PLCs. It includes an LED display, 0.56 in., 14 segments; RS-232 or RS-485 serial port; USB device and Ethernet TCP/IP. The display and controller can be separated up to 250 ft. Operator functions through Menu key include audit trail, preset tare, accumulator, time and date, and setpoints.
Rice Lake Weighing Systems; 800/472-6703; www.ricelake.com

GET IT ALL TOGETHER

VTScada 11 SCADA software pre-integrates all core SCADA components with one installation. Users configure redundant servers, distributed historians, mobile access or communications with any combination of I/O. Idea Studio provides a drag-and-drop interface for creating professional displays. Operators can create and save their own trends.
Trihedral; 800/463-2783; www.trihedral.com

SOFTWARE SERVICE

Service Pack 2 (SP2) for Web Studio 7.1 software provides native support of HTML5 screens and animation for multiple devices and platforms, including Safari and Chrome browsers. Web Studio lets users create screens once using the standard screen editor, and then deploy these screens across multiple operating systems on various handheld devices via the Studio Mobile Access interface. SP2 provides built-in troubleshooting tools for the native VBScript editor.
Indusoft; 512/349-0334; www.indusoft.com/

THREE CHOICES

EZPanel PC HMI combines EZTouch software, with-universal connectivity to all PLCs, with a Windows 7 fanless industrial panel computer. With an Intel Atom E640 1-GHz processor with 1 GB DDR RAM, in 10- and 15-in. models, it comes standard with 4 GB of SSD memory, four USB ports, a MicroSD card reader, two serial ports and a 1-GB Ethernet port.
EZ Automation; 877/774-3279; www.ezautomation.net

MANY FEATURES

GT16 Series HMI offers remote access, multi-language text and graphic support, alarm management with

conditional sequencing for use with multimedia files, front-mounted USB port and embedded diagnostics and maintenance functions. The terminals come in six sizes from 5.7 to 15 in. Additional capabilities include flexible recipe management, data logging and a range of drivers to support connectivity to most automation vendors.

Mitsubishi Electric Automation; 847/478-2100; www.meau.com

PERFORMS IN EXTREMES

VisuNet XT operator workstation with global certifications has a high-bright, LED-backlit LCD panel with an optically bonded, glove-friendly and sunlight-readable 15-in. or 19-in. touchscreen. An Intel Core i7 processor supports modern software applications. The Type 4/4x operator workstation operates in temperatures ranging -40 to 65 °C.

Pepperl+Fuchs; 330/486-0002; www.pepperl-fuchs.us

MORE THAN ONE POV

Point of View software for SCADA, HMI and OEE/dashboard projects can be deployed anywhere for most Windows-supported platforms, including Windows XP, 7, 8 and Server editions. It can either run locally on a development workstation or be downloaded to a remote workstation to operate using Point of View runtime software. Animated HMI screens and OEE dashboards give personnel a graphical view of the process. Integrated modules include alarms, events, trends, recipes, reports, scriptable logic, schedulers, a security system and a complete database interface.

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

MOBILE APP

Working natively from Windows 8.1, FactoryTalk VantagePoint Mobile App users can access VantagePoint centralized reporting and analytics from the software suite. Within the app, users can view key performance indicators such as energy use, overall equipment effectiveness (OEE) or mean time between failure/mean time to repair (MTBF/MTTR). By touching the KPI gauge or chart, users can dive deeper into the FactoryTalk VantagePoint portal to see full, detailed reports and trends driving those metrics.

Rockwell Automation; 414/382-2000; www.rockwellautomation.com

WORK ON THE WEB

WebOP-3000 web operator panels with a flat-panel, IP66-certified aluminum edging include Intel Cortex-A8 processor, are designed to work in temperatures -20 to 60°C and support CANopen, Modbus and Ethernet protocols. They have dual level-four electrostatic discharge (ESD) protection and meet IEC-61000 requirements. To protect the units from sudden spikes in the electricity supply, they're equipped with power and terminal I/O port isolation protection, so that in the event of power surges, the panel's components will not be affected. Data loss from power failure is protected by 128-KB FRAM that doesn't require a battery.

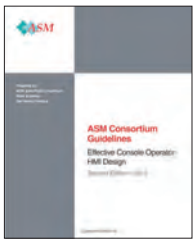
Advantech Industrial Automation; 800/205-7940; www.advantech.com/ea

HMI CHOICES

Graphite HMIs are full-color touchscreens in eight models and 7-, 9-, 10-, 12- and 15-in. widths, and have an operating range of -10 and 60 °C. They directly accept I/O modules for PID control, dc voltage and current, thermocouples, RTUs and other components. They include a built-in web server to remotely monitor and control applications. Built-in protocol converter lets programmers select 13 or more simultaneous protocols from a list of more than 250. All capabilities are supported by Crimson 3.0 software.

Red Lion Controls; 717/767-6511; www.redlion.net/graphite

DESIGN UPDATES



Second edition of *Effective Console Operator HMI Design Practices* is based on the consortium's research in the prevention, mitigation and management of abnormal situations for individuals who establish company HMI standards, style guides and information displays accessed by console operators through their control system workstations. This revision is based on the consortium's user members' current best practices, recommendations from recent ASM research, feedback from display design experts, and HMI technology advances.

ASM Consortium; www.asmconsortium.org

INTEGRATED HMI

XV Series HMI incorporates PLC functionality and integrates directly with the SmartWire-DT system to enable remote intelligence, eliminate an entire device level, and make complex wiring unnecessary. With a 400 MHz RISC processor and custom-developed software drivers, the XV Series employs IEC 61131-3 compliant xSoft-CoDeSys-2 programming software for visualization, logic and end devices in one software package.

Eaton; 800/386-1911; www.eaton.com

RESISTANCE IS CERTAIN

Magelis GTO stainless HMI panels have six 65-K color TFT screens, LED backlighting, and function keys for the 3.5 and 7 in. versions. They operate to 55 °C, and resist corrosion, high-pressure cleaning, chemicals and grease.

Schneider Electric; 800/788-1704; www.schneider-electric.us/com

STILL IN TOUCH

Open and extensible InTouch 2012 HMI software lets users create standardized, reusable HMI and real-time decision support applications that shorten project times. Improvements include strengthened security, simplified installation and license management, support for the latest remote desktop services and virtualization technologies from Microsoft.

Wonderware; 800/966-3371; iom.invensys.com

TOUGH TOUCH

Series 4020 all-weather, portable PC has a NEMA 4X aluminum enclosure with UV-tolerant paint finish, is Class I, Div. 2 (approval pending), Zone 2 NI, EExnA IIC T4, EXII36, and complies with ATEX 94/9/EC. It has an active-matrix, LED-backlit, 15 in. LCD with shatterproof, pressure-sensitive touchscreen, 1.3 GHz Intel Atom processor, solid-state storage, and a variety of I/O ports.

Daisy Data Displays; 717/932-9999; www.d3inc.net

MAGIC HMI

Panel Magic 21.5 in. widescreen LCD is sealed against the elements when panel-mounted, with NEMA 4X stainless steel bezel. It includes 1920x1080 resolution, optional resistive touchscreen, and integrated or removable computer. Six LCD sizes range 12–42 in.

Comark; 508/359-8161; www.comarkcorp.com

GO REMOTE

Pro-face Remote HMI works with screen development software GP-Pro EX v3.1 or later, and allows users to monitor and control HMI screens from a smartphone or tablet without special programs to reduce work time by letting users see machine information from anywhere in the factory. It can monitor the status of multiple machines from one device, and works on any tablet or smart hone running Android or iOS.

Proface America; 800/289-9266; www.profaceamerica.com/remotehmi CD

Programmed Safety Pays Off

by Hank Hogan, contributing editor

ACHIEVING SAFETY ISN'T a risky business—if you have the right solutions and tools. That's where safety PLCs come in, as these systems can make factory floors less dangerous to people, product, the environment and other machines. But to get the most out of the technology, it helps to know the basics.

It comes down to understanding and reducing risk.

For instance, a safety PLC differs from its standard cousins in a few important respects, says John D'Silva, safety technology manager at Siemens Industry (www.usa.siemens.com). One involves communication. For instance, Profisafe, a safe protocol layer that runs atop industrial Ethernet, has consecutive numbering of messages, time expectation with acknowledgement, a unique codename between sender and receiver, and cyclic redundancy data-integrity checks.

"A receiver can see whether or not it received the messages completely and within the correct sequence," D'Silva says of an outcome of these safety integrity checks.

Together, they reduce the risk of a communication breakdown. If one occurs, then the safety PLC, operating according to its programming, can initiate necessary actions, such as stopping a machine. The same set of actions might be taken by distributed fail-safe I/O with built-in redundant microprocessors.

Another key difference between a safety and a standard PLC involves system diagnostics. A safety PLC has a more extensive set, and these cover a greater number of exceptional situations, such as relevant unsafe conditions. This greater and more complete diagnostics capability reduces risk by minimizing or eliminating the chance of an undetected fault. Such data also can decrease downtime by providing information needed for troubleshooting, which means the safety PLC might be able to pay for itself.

A third way that safety controllers differ from standard PLCs involves internal configuration and components. For instance, they have multiple processors monitoring an application. These cross-check each other, but this doesn't preclude the processors from performing other tasks. For example, Rockwell Automation (www.rockwellautomation.com) says its GuardLogix safety PLC handles both standard control and safety functions.

"We have two processors, and each of the processors is executing the safety tests to look at and compare all of the safety information from the application," says Geoff Sieron, GuardLogix safety controller product manager. "In one of the processors, we're executing all of the standard control tasks."

Finally, standard and safety PLCs have a paper difference. The latter achieve a given level of reliability in terms of failure rates. This performance is not something to which only the system manufacturer attests.

"A safety PLC will carry a certification describing the reliability of the system, because, since you're dealing with safety, there are standards and regulations that describe requirements for minimum levels of reliability and for third-party certifications," says Gil Dominguez, safety consultant with Pilz Automation Safety (www.pilz.com).

> "Understand the risks associated with your machines, how everyone interacts with them, what job functions they do and how sneaky they can be at bypassing features."

The question of certification brings up an important point, he adds. Different industries must answer to different regulatory bodies, and thus, any certification must be acceptable by the regulator with jurisdiction. Likewise, geographical regions have different regulators. At one time, there was a lack of regulatory consistency between regions, which sometimes lead to conflicting directives. However, that problem largely has been addressed, thanks to harmonization of rules and edicts.

An important point to remember when you consider a safety PLC is that it can be overkill for some situations. A very simple machine with only a handful of I/O or a limited number of safety functions might need only one or more safety modules, which can be programmable or discrete. The threshold at which it becomes cost-effective to use a safety controller is measured in a few tens of combined I/O points and safety functions, Dominguez says.

To consider any safety PLC or even whether to use one at all, it's critical to keep in mind that the objective is an acceptable level of risk. Ashok Acharya, senior product marketing manager at GE Intelligent Platforms (www.ge-ip.com), notes that determining this includes a risk analysis based on both the process

and the machine. That is followed by an iterative evolution in which risks are addressed systematically, and any impact they might have is reduced. When the estimated risk and impact fall below the designated target, the application can be considered acceptably safe and the iterative process is complete.

While this ratcheting down of risk is going on, the question will come up about what is necessary with regard to the system's safety integrity level (SIL). SIL addresses the chance of random, not design, failures, Acharya says. He adds that attaining a higher level of protection is something that should be considered. "The cost versus SIL level equation is the key consideration," Acharya says. "For a small delta in cost, if a higher SIL rating can be accomplished, then that incremental cost is worth it."

A key difference between a safety and standard PLC involves system diagnostics. A safety PLC has a more extensive set, and these cover a greater number of exceptional situations, such as relevant unsafe conditions.

Other factors also can play a role in the selection of a safety PLC. The system, after all, will be a computer that either monitors a stand-alone system or monitors and controls an integrated system, a process. Thus, ease of programming and connectivity options of a safety PLC can be important elements to evaluate.

Tina Hull, safety product engineer at Omron Automation and Safety (www.omron247.com), notes that a safety PLC uses test pulses and other diagnostics to spot problems that a standard system would miss, such as contacts that have been welded closed and cannot open. This check can be accomplished by dropping a 24-V signal periodically down to 0 V, with the controller looking at the return to determine that contacts and other components function as they should.

Selecting a safety PLC and other safety devices is the easiest part of the process of mitigating risk, Hall says. The real challenge takes place before that, when a risk assessment is being done.

As she says, "First, understand the risks associated with your machines and processes. Understand how everyone interacts with the equipment, what job functions they need to do and how sneaky they can be at bypassing features." CD

How Do We Tone Down Device Chatter?

WE BUILD AND support a lot of one-off machines, so we deal with a variety of networked hardware and components. The components get smarter all the time, and often phone home with problems and events that are as much a nuisance as anything else. Device suppliers all seem to have different and often laborious steps to filter the nuisances, while not crippling the important device diagnostics. Are there standard or standard-based approaches to this?

– From December '13 Control Design

ANSWERS

Make It Meaningful

While we'd usually agree "more is better" when it comes to operational data phoning home, the key phrase becomes "more meaningful is better."

In our experience developing material handling solutions with predictive maintenance alerts and sorting through constant data pushing back to the OEM, we've found it best to first understand exactly what all this data means and then how it translates to actionable requests of the user/maintenance staff. It is easy to lose the critical calls to action if you're drowning in "FYI" information.

TIM KRAUS, product manager, line sortation,
Intelligrated, www.intelligrated.com

Give the Problem to the Controller

Maintaining a current, accurate alarm and event status in an architecture can be challenging. Because a traditional alarming system stores the status and alarm state in the human-machine interface (HMI), keeping the view from operator-operator or database-database has been difficult. Rebooting an alarm server might require rebuilding the state of the alarm manually, but then you're left with the question of whether the alarm is acknowledged or if it's suppressed.

Our FactoryTalk software's Alarms and Events rewrites this paradigm by moving all alarm configuration (including alarm messages) down to the controller where the alarm conditions are monitored.

As part of the Services Platform, Alarms and Events provides components that allow FactoryTalk-enabled products to participate in a common, consistent view. It manages alarms and events throughout a FactoryTalk system.

You can eliminate the problems of traditional alarm and event systems, such as programming required in both the controller and the HMI software; alarms being detected and processed twice; heavy polling between the HMI and controller tags resulting in heavy network overhead; and alarm time stamps being delayed because they are applied by the HMI after polling and processing.

Our Alarms and Events creates a consistent user interface for visualization and management across the entire control system and significantly reduces network traffic due to alarm reporting by exception.

ROB SNYDER, product manager, networks and security business,
Rockwell Automation, www.rockwellautomation.com

Divide and Conquer

Machines do tend to want to tell you all about their day in great detail. Generally, there are a couple ways to address this situation.

From a high level, one way to limit this communication is to break your network up into different subnets. This means any multicast or broadcast messages sent by your industrial machines are contained within the local subnet, thus not "spamming" the rest of your industrial network with messages others don't care about. Just remember that once you use subnets or VLANs to achieve this segmentation, you will need a router somewhere on your network.

One way to limit this communication is to break your network up into different subnets. This means that any multicast or broadcast messages sent by your industrial machines are contained within the local subnet, thus not "spamming" the rest of your industrial network.

Another approach is to use a router/firewall with deep packet inspection (DPI). With this function enabled, an intelligent firewall device can filter out certain types of messages and allow or disallow accordingly. Coincidentally, this same router/firewall appliance can also filter out broadcast messages, thus limiting the amount of chatter on your network, as mentioned previously.

JIM TOEPPER, product marketing manager,
Industrial Ethernet Infrastructure
Moxa Americas, www.moxa.com

[Here are parts of the thread of responses we received when we posted the question on LinkedIn's Automation.com group.]

How About a Daily Summary?

To address this, my question would be: "Do we really need all of the warnings, faults and alarms that are programmed into the control system?" Could they not simply be tallied and examined at the start of the morning shift, for example?

KEVIN SHANAHAN, senior automation engineer
Andritz Metals, www.andritz.com

Use Secondary Logic

One approach that many of our customers implement is the idea of a secondary alarming system. Bring the device alarms into a second system where you can apply additional logic to determine which device alarms are important and require notification or operator action.

A secondary alarm system allows this type of logic to be customized while leaving the vendor alarms alone. The secondary "smart alarms" can then be the events that are acted upon or reported.

For example, a single device alarm might not be important, but the persistence of this alarm for five minutes or 10 occurrences of the device alarm within 30 minutes could be significant.

A secondary alarm system allows this type of logic to be customized while leaving the vendor alarms alone. The secondary "smart alarms" can then be the events that are acted upon or reported. As Kevin suggested, they also can be summarized and reported (e.g., daily report via email) in addition to notifications at the time of the events.

DANE OVERFIELD, software product development,
Exele Information Systems, www.exele.com

These Standards Will Help

ISA18.2 is a standard which uses the term "instrument diagnostic alarm." The NAMUR NE107 recommendation is the industry standard for categorization of instrument diagnostic alarms as common/uniform "status signals" for "failed," "off specification," "maintenance required," and "check function." This means device diagnostic alarms from all kinds of devices can be filtered and displayed consistently across all kinds of software. For instance, you can chose to only alarm operators in case the alarm is "failed," affecting the process, not for the less serious "off-specification" and "maintenance required" that do not impact the process yet and should only be routed to the maintenance system.

Device diagnostic alarms from devices can be filtered and displayed consistently across all kinds of software. For instance, you can chose to only alarm operators in case the alarm is "failed," affecting the process, not for the less serious "off-specification" and "maintenance required" that do not impact the processs yet.

See the "Device Diagnostics Deployment and Adoption Guide" found at www.eddl.org/DeviceManagement/Pages/DeviceDiagnostics.aspx. The ISA108 committee is also working on the work process for using the NAMUR NE107 capability.

Make sure to use devices and systems supporting NAMUR NE107. For example, http://bit.ly/1k4T7ZM.

JONAS BERGE, director, applied technology,
Emerson Process Management, Singapore,
www.emersonprocess.com

APRIL'S PROBLEM

IT'S INTERESTING TO watch the BYOD movement leak into the manufacturing space, but we have some concerns. These days, many larger customers or potential customers are doing it to some degree in their IT groups. We've been successful with the plug-in orwireless pendant for multi-station HMIs; we know it well, and it does the monitoring and control our customers need. It seems inevitable that any day now an RFQ will include tablet or smartphone wireless HMI requirements. We'd like to have a few legitimate, technical performance reasons that argue for keeping what we have. Or is it time look for a seat on the bandwagon?

SEND US YOUR COMMENTS, SUGGESTIONS OR SOLUTIONS FOR THIS PROBLEM. We'll include it in the April '14 issue, and post it on ControlDesign.com. Send visuals if you'd like—a sketch is fine. Email us at ControlDesign@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.

Demote the False Alarms

Read the 2009 ISA-18.2 standard on alarm management. Alarms are notifications that meet the definition of an alarm. An alarm is defined as "an audible and/or visible means of indicating to the operator an equipment malfunction, process deviation or abnormal condition requiring a response." The key required elements: "to the operator," "abnormal" and "requiring a response."

Many things that vendors call alarms do not meet the definition. The alarm system is reserved only for things that meet that definition. Everything else should be handled in some other way than use of the alarm system.

Most alarm systems are mixtures of important things that meet the definition and trivial things that do not. There is also a Linkedin group on alarm management.

If you want a white paper on understanding and applying ISA-18.2, just send me an email at bhollifield@pas.com.

BILL HOLLIFIELD,
principal alarm management and HMI consultant
PAS, www.pas.com

Simplify

As a system integrator with 23 years working on projects, for me there are two problems here that must be solved.

First, deal with the alarm avalanche. That means that with an alarm like 'Pump Stop,' there are many other alarms chained with that one; i.e., Network Failure, Motor Overtemperature, High Pressure, etc.

The first step is to implement a logic that only accepts the first alarm and inhibits the chained ones. That minimizes the alarm quantity and makes it faster to identify and solve the problem.

The first step is to implement a logic that only accepts the first alarm and inhibits the chained ones. That minimizes the alarm quantity and makes it faster to identify and solve the problem.

Second, make alarms that must represent a sector or large or crítical equipment. If the person who receives the message wants to have more information, he can communícate with the plant or access a remote visualization from a cellphone, tablet or notebook.

CRISTIAN OYANEDER, owner, SA Asinpro,
www.linkedin.com/pub/cristian-oyaneder/3a/b94/b44/en CD

TOWERING LIGHTS

LS7-9 Series signal light towers are IP69K-rated, with no exposed screws, shafts or other metal components. These stackable devices have optional M12 quick disconnects and eliminate the need for a separate relay box. Models are available in three- or five-light tier configurations with a wide range of user-selected colored LED light arrangements. A 2,000-3,000-Hz buzzer is an option.

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ABB; 262/780-3000; www.abb.com/plc

HIDEAWAY PLC

FX3S battery-less PLC for space- and cost-conscious applications requiring up to 30 I/O includes integrated ac power supply, maintenance-free EEPROM memory, built-in USB port for the programming communication function to enable high-speed communication at 12 Mbps, built-in positioning control and integrated real-time clock. Programming is via GX Works2 or GX Works2 FX.

Mitsubishi Electric; 847/478-2100; www.meau.com

MAKE GOOD CONTACT

GH15 electric contactors include frame sizes 79 mm to 145 mm, and are available up to 315 A. The IEC motor controls feature self-lifting pressure plate terminals; actuator coils, in 110/220 V and 220/240 V, 60-Hz models, accommodate most applications. In IEC sizes from B to TT, the contactors accommodate up to 250-hp motors at 460 Vac. They are CE-marked, cULus-listed, RoHS- and REACH-compliant.

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

QUITE THE CONNECTION

Connected Components Accelerator Toolkit (CCAT) and Connected Components Workbench software tools are designed to integrate the machine-control development process. Machine builders choose their controller, and the toolkit provides a full suite of compatible components and application development tools, including a list of compatible materials; panel layout and wiring drawings (usable in CAD software); prewritten control programs; quick-start guides; and sample HMI screens, including diagnostics. The toolkit provides a bill of materials electronically, and once panels are designed and built, the Workbench software enables machine builders to program controllers, configure devices and design HMI screens.

Rockwell Automation; 414/328-2000; www.rockwellautomtion.com

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Emerson Industrial Automation; 800-626-2093; www.emersonindustrial.com

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Hitachi-America; 914/332-5800; www.hitachi-america.us CD

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Design With Maintenance in Mind

WITH THE TRUE cost of downtime being so high, maintenance-friendly control panel design is required to reduce that downtime. Often, end users feel equipment maintainability is low on the designer's priority list or just an afterthought.

The lack of maintainability concerns in control system design can be attributed to oversight, initial-cost reduction and not understanding installation and usage scenarios.

In our PLC training classes, we give the example of the outdated mindset that says, "Whoever writes the program in the least amount of code is the best." Less code might have been true in the early days when memory and processing power were limited. Nowadays, with plenty of memory and processing power, the objective is to write the simplest program for the layman to understand and work with, in troubleshooting, for example.

A part of today's maintenance requires using the PLC, programmable automation controller (PAC) or other control device to make minor changes and to troubleshoot otherwise complex equipment. Maintenance personnel understand ladder logic more than they do structured text or other Pascal-like computer

> We relate the example of the outdated mindset that says, "Whoever writes the program in the least amount of code is the best."

programming languages. Even if you are more comfortable programming in structured text, the program should be in ladder logic for better maintainability. Of course, there can be exceptions, but the rule should be "simple for non-technicals to work with."

Here are some considerations for designers and builders of control panels that will help ensure the panels' maintainability:

- Have an outside-the-panel PLC communication port and fused 120-V outlet.
- If it's an ac-powered PLC, have the line filter on 120-V control power come off the transformer's secondaries.
- Give customers a well-documented copy of the PLC program on CD or access to a cloud-hosted version.
- Bring critical warning lights, such as PLC fault, battery, force comm, outside the panel or to the HMI.
- Use aux contacts on E-stops and disconnects to detect them in the PLC and/or HMI.
- Write predictive maintenance (PdM) logic in control to further enable reductions in your customers' unscheduled downtime.
- Always break up logic into organized sub-routines for user ease of understanding and navigation.
- Use agile programming designed to accommodate change.
- Program preventive maintenance (PM) alerts, including electrical PM alerts, into equipment.
- If PLC vendor software does not provide processor status bits and a word-structured view in a data table, create a subroutine that displays important processor status tags for easy troubleshooting. Be sure to include processor fault codes, real-time clock, first-scan status bit, etc.
- Consider providing PLC program backup on a PLC EEPROM in a PLC that reloads the program automatically on memory fault.
- Use fewer possible connections to reduce electrical PM time and increase overall reliability.
- Clearly mark or label spare I/O on terminal blocks.
- Ensure that service techs and start-up techs clearly document changes, and share that documentation with maintenance.
- Have automated warning alerts if neutral-to-ground voltages exceed 2 V, or if there are other indicators of harmonics that can fault PLCs or other solid-state control devices.
- In larger panels, include illumination for safety and ease of maintainability.
- Consider panel-temperature monitoring, particularly an over-temperature warning.
- Provide all manuals and documentation in searchable PDF digital format on CD and offer a cloud-hosted version.
- Include recommended parts to stock and mean time between failures (MTBF) rate in manuals.
- When MTBF is not of value (as for intermittent electro-mechanical devices), then provide the activations between failures (ABF) rate.
- Monitor MTBF/ABF for key components and indicate warnings in the controls as the component approaches its MTBF/ABF.
- Consider remote access for PdM measurements in panel designs, so measurements can be made without opening panel when possible. CD

DON FITCHETT is president of Business Industrial Network, an industrial training company. Learn more about the company and Don's extensive background at www.bin95.com.

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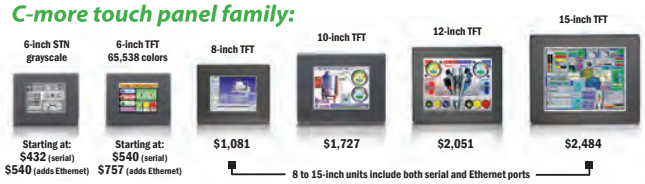

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