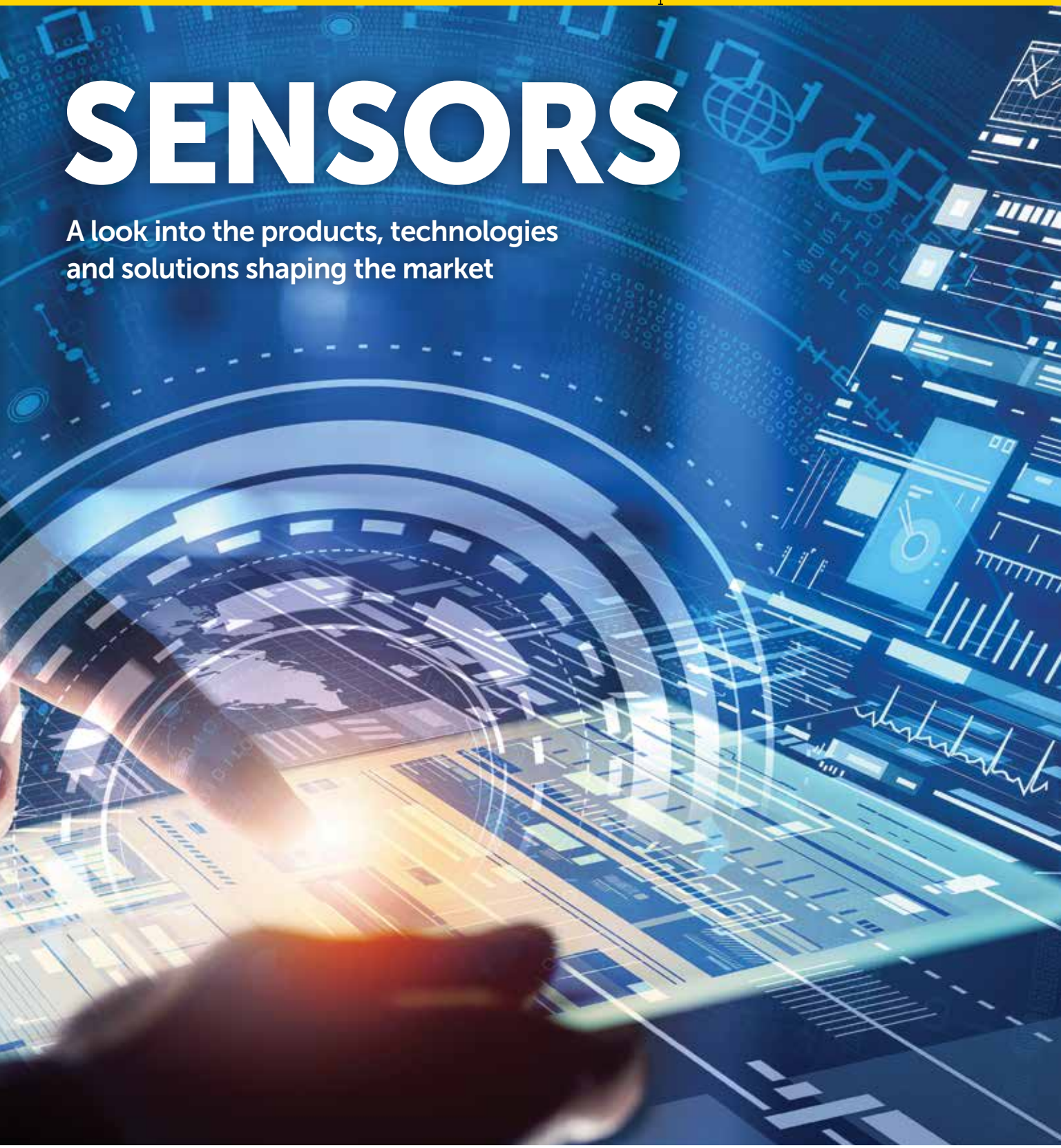
Technology Handbook

Digital supplement to
MANUFACTURING AUTOMATION

SENSORS

A look into the products, technologies and solutions shaping the market



A-TECH INSTRUMENTS LTD.
MEASUREMENT & CONTROL FOR RESEARCH & INDUSTRY

Have a Pressing Need to Improve Quality?

Upgrade any Press with Universal Press Force Monitoring Solutions

In today's automated manufacturing environment, no quality control operations can be left to chance. We've applied our experience in pressing operations and wide selection of sensors with flexible tools that will allow you to acquire signatures in order to define the process pass/fail criteria. These monitoring systems have evaluation tools that can be used to differentiate between good and bad process signatures, while quickly providing feedback to the PLC.

Turn Key Solutions: Sensors, Cabling, Instruments and Data Collection.

A typical system will use a load cell appropriately sized for the application and a displacement sensor to measure the entire travel of the pressing operation.

The same basic concept works for an application with small load signatures measured during the assembly of plastic components in a medical device and up to the large forces required to assembly large bushings found in suspension of industrial vehicles.

These sensors are connected to an instrument that collects the measurements, plots them "load vs position" and compares them to a "good" signature or curve.

The types of load cells and displacement sensors used in these applications are wide and varied and defined by the forces and distances to be measured, as well as the space available. The instrument performing the Signature Analysis varies depending on the types of measurement evaluation, the complexity of the signature, the communication to the PLC and the data storage device.

Example Applications

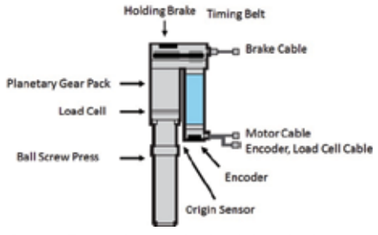
- Suspension Bushings Insertion
- Pressing Dowel Pins in Engine & Transmissions
- Insertion of Bearings, Valve Seats, Valve Stem Guides, etc.
- Electrical Connector & PCB Pin insertion
- Medical device assembly and operation verification
- Stamping, Clinching, Bending, Hemming, etc.

Integrated Servo Press System

The Coretec Integrated Servo press is a cost effective package with superior control on force & displacement, as well as built-in monitoring & data collection. The next generation assembly technology is now within reach, improving production efficiency and reducing scrap. In manufacturing automation there are many factors for process improvements. Speed, Control and Cost are important factors. The press-fit assembly process and the monitoring criteria has evolved considerably in the last few years, and continues to evolve.

Next Generation Capability at an Affordable Price

Today there is a demand to monitor the interference fit of parts verifying that they are assembled correctly. This is where the



Servo Press is revolutionizing industry, providing the control and monitoring capabilities needed to increase efficiencies, at a cost that rivals traditional presses and monitoring packages.

In order to improve the process, you need better tools.

Ball Screw Servo Presses use an electric motor coupled to a ball screw mechanism to transfer the rotational drive to linear force. Virtually all electric motors have built in encoders, allowing them to control position and speed. However, controlling on displacement and speed is only half the equation when performing a press-fit process. We measure the forces associated with these processes to allow accurate judgement of pass or fail criteria. The Coretec Servo Press is supplied with an integrated load cell and encoder that allows real time feedback for the control and monitoring of the process.

It's time to take control of your assembly process.

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Baumer

Simon says "CleverLevel is a switch for all media"

Level detection is of great importance in many industries. The demands on level switches can vary considerably, from monitoring maximum and minimum levels in tanks, to protection against overflow or running dry. Until now, engineers have needed to specify from a wide assortment of different sensors, depending on the specific application. It was simply not possible to cover all applications with one type of level switch. The CleverLevel has changed all of that, allowing just one sensor to be used for almost any point level application.

There are many factors to consider in level applications, such as foam presence, viscosity, stickiness, and the aggressiveness of the media. The commonly used vibrating fork level sensor does not offer great performance in all of these situations. Measuring errors can arise, since high viscosity materials tend to stick to these forks. Coarse granular media can easily become lodged between the forks and also cause measuring errors. The forks are difficult to clean. Also, liquid and powder substances required different fork sensor versions.

Versatile sensor with easy configuration

The CleverLevel sensor is able to reliably detect levels in virtually any media. Based on frequency sweep technology, the sensor continuously analyses the resonant frequency around the sensor tip. All materials have a die-electric value. The die-electric value directly affects the resonant frequency, allowing the sensor to reliably detect the presence of the material. High sensitivity for dielectric constants from 1.5 to over 100 enables limit detection for all sorts of powders, granulates and liquids.

Out of the box, the CleverLevel factory default setting can already detect most media. A Teach-in function can be used to further customize the sensor for trickier applications, such as ignoring foam, sticky residue or other material stuck to the tip. Tanks with liquid chocolate are a typical example. Even when empty, the sensor and container walls are coated with chocolate. When configured accordingly, the CleverLevel still switches only when the tank is really full or empty. A simple configuration software shows the user a clear graphical representation of what the sensor sees, and makes setting the sensor easy, even for difficult applications.

CleverLevel can be installed in any orientation. A bright blue signal LED is highly visible from all directions. The sensor housing is IP67 as standard, and it is suitable for ambient temperatures between -40°C and +200°C. The small mounting depth of only 15 mm is a plus for many applications. In addition to the industrial process connections, there are also versions with EHEDG approval for food areas and other areas with strict hygiene requirements. The PEEK sensing tip is compatible with most solid materials, oils, chemicals, and solutions.

See why Simon says "CleverLevel is a switch for all media". Click the link for more information or call Baumer for a demonstration of this game-changing new technology.

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MOD-TRONIC INSTRUMENTS LIMITED

Temperature Sensors for Optimal Performance

Mod-Tronic offers the perfect fit for any temperature and humidity sensing application. From miniature detectors to 100 foot aver-aging thermometer and heavy duty probe assemblies, our selection lets you choose the best model for your needs.

Sensing technology options provide flexibility

Mod-Tronic can supply sensors to work with nearly any type of instrument.

- Resistance Temperature Detectors (RTDs)
- Platinum RTDs with wide range of TCRs
- Range from 0.00375 to 0.003927
- 0.00385 (Minco element "PD") is most popular
- Nickel, copper, and nickel-iron RTD elements
- Non-standard resistance-temperature curves
- Base resistances up to thousands of ohms
- Thin film or wire wound constructions
- Thermistor temperature sensors
- Thermocouple temperature sensors
- Integrated Circuit temperature sensors
- High accuracy humidity sensors and transmitters
- Signal conditioning
- Linearizing transmitters with 4 to 20 mA, 1 to 5 VDC, or other voltage/current outputs
- Explosion-proof temperature and humidity sensor and transmitter assemblies

- Controllers, monitors and alarms for optimal compatibility with sensors

From simple elements to complex assemblies

Mod-Tronic can configure a sensor style to best fit your application and capabilities:

- Basic sensing elements for assembly into your own housing or protective sheath
- Addition of leadwires and terminations to elements
- Packaging into protective sheaths, laminates, custom housings, cabling
- Bendable case designs or preformed to your specifications
- Assembly with fittings, connection heads, thermowells, connectors, feedthroughs
- Assembly with signal conditioning electronics, standard or customized
- Certified measurement and test in our metrology lab
- Certified designs for hazardous locations

Machining and materials

A sensor's construction has a large impact on its thermal time response and resistance to corrosive media. Minco has an ad- vanced machine shop with CAD/CAM capability for economic production of cases and fittings.

We have extensive machining capabilities in a variety of materials:

- Stainless steel in various grades
- Brass
- Copper
- Monel
- Hastelloy
- Titanium
- Rubber, PTFE, plastics

We can plate with nickel, gold, and other metals. Additional services include electro-polishing, passivating, and pressure testing.

Leadwires

Sensors may be furnished with many different types of leadwire and cables to meet application parameters:

- PTFE, silicone rubber, polyimide, Tefzel, PVC, mica/glass, and glass braid insulation over silver or nickel plated copper wire are common selections or specify your own leadwire or cable requirements
- Stainless steel overbraid or flexible armor
- Flat ribbon leads or sensor/flex circuit hybrids

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Your automation, our passion.

PEPPERL+FUCHS

The R2000 series 2D laser scanner offers a wide range of innovative advantages. PRT—the true time-of-flight measurement—allows reliable and precise measurements in industrial environments. Very small objects are reliably detected, even at long distances. Two versions of the R2000 are available for your applications.

R2000 UHD

2D Laser Scanner with Unmatched Precision and Measurement Capability

R2000 UHD, the multiple award-winning 2D laser scanner from Pepperl+Fuchs, is perhaps the most celebrated and recognizable sensing product in our company's history—and with good reason. The R2000 is truly unlike any 2D scanner that has come before it. It provides ultra-high density (UHD) measurement capabilities by combining a host of unique technologies and innovative features in an incredibly small housing. The measurement accuracy and technological superiority of R2000 UHD is off the charts, but in order to harness this capability, users must have an external PC and also create custom software algorithms specifically for the application.

- Up to ¼ million measurement points/s
- Angular resolution down to 0.014°
- Rapid scan rate of 50 z
- Fast Ethernet interface – TCP/IP protocol

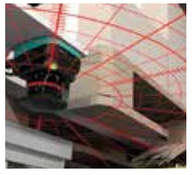
A General-Purpose R2000 UHD, Please!

Immediately following the introduction of the R2000 UHD, we began to receive a tremendous amount of positive feedback as well as an unprecedented number of requests for a device that provides the same level of precision and capability as the UHD model, but for general-purpose use—a device with a simple user interface and more intuitive way for users to create detection "fields."

A device that does not require the customer to write software in order to use it—and also something that is dead simple to use with or without a PLC.

We heard our customers loud and clear!

R2000 Detection



Generally and Purposefully Intuitive and User-Friendly

We are now extremely proud to introduce the second product to bear the R2000 name, the **R2000 Detection.** R2000 Detection delivers on precision and capability with an angular resolution of just 0.071°, a fast scan frequency up to 30 Hz, the ability to detect very small objects down to 1 mm, and much more. But just as important, R2000 Detection is a *general-purpose device*, equipped with discrete I/O and user-configurable detection fields. Each field can be edited and assigned to a specific, discrete output with intuitive and user friendly software. After configuration, save your settings, then wire to your PLC as you normally would with any other sensor. Best of all, the software is free of charge!

- Simple setup - define up to 4 fields
- Angular resolution within 0.071°
- Scan frequency up to 30 Hz
- 4 discrete inputs/outputs (selectable)

What is PRT?

Pulse Ranging Technology – true time-of-flight technology

Sensors with PRT emit a very short, high-intensity light pulse and calculate object distance based on the speed-of light and time-of-flight of the reflected light pulse. Unlike other time-of-flight sensors that emit a continuous light beam, PRT sensors emit light pulses up to 250,000 times per second. Compared to a continuous source, the energy density of one PRT pulse can be up to 1,000 times greater, allowing stable and highly reliable detection, even at distances of 300 meters or more. In contrast to triangulation-based sensors, the detection range of a PRT sensor is not limited by the geometrical layout of the sensor optics. Consequently, PRT sensors can take advantage of smaller housings while still providing significantly larger detection ranges.

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www.pepperl-fuchs.ca

Providing unmatched precision.
Delivering 360° performance.
Advancing intuitive control.

R2000 Detection
2D Laser Scanner

- Stable, wobble-free scanning axis for precise field monitoring
- Highest angular resolution on the market allows detection of extremely small objects
- User-defined detection fields make configuration simple, intuitive, and user friendly

www.pepperl-fuchs.us/r2000

Your automation, our passion.

PEPPERL+FUCHS

TOP 5 IN 2016

Key trends and technologies hitting your plant floor this year

COMPILED BY ALYSSA DALTON

Just in time for the New Year, *Manufacturing Automation* has compiled the top trends and technologies Canadian manufacturers should watch out for in the next 12 months, as predicted by a handful of industry experts. Unlike last year's diverse mix of predictions, this year's experts all noted the Internet of Things (IoT) and the emerging Industrial IoT (IIoT) as top gamechangers, as well as big data and Information Technology (IT) and Operational Technology (OT) convergence. As Naveen Kumar of Frost & Sullivan (first expert listed below) pointed out, 2016 will be an important year as the industrial sector "readies itself for the digital overhaul."

Naveen Kumar, Frost & Sullivan senior industry analyst, holds five years of consulting experience in the industrial automation space. He helps companies achieve growth, innovation and leadership with his expertise in corporate strategy and competitive intelligence.

1. Internet of industrial sensors

As machine-to-machine (M2M) communications begin to mature, sensors will be widely deployed to monitor remote assets, measure energy consumption, track environmental compliance and improve asset visibility. Integration of several sensor technologies with edge analytics drives the asset performance, reliability, safety and security. As attention increases towards asset performance management, new low-cost wireless sensors are expected to be deployed in existing installed base to collect several data that were earlier considered inaccessible due to technology limitations and budget constraints. With the improvements in instrumentation technology, miniaturization and advanced analytics software, the cost of intelligent sensors is coming down as well as its ease of use. With sensorization of industrial assets, failing parts in an asset can be spotted very early to avoid undesirable downtime consequences. Process critical applications in asset intensive industries will likely uptake the sensorization to remotely monitor and control at a high level of operational efficiency. The market dynamics around interoperable issues caused by multiple connectivity standards (no standardization) have been keenly observed by the industry participants. However, increased adoption of Internet of industrial sensors in large-scale deployments triggers the best practice solutions, widely accepted standards and market consolidation.

2. Industrial big data analytics

With the increased deployment of sensors and connectivity technologies, emergence of industrial big data pipeline will drive analytics applications for asset maintenance. Software driven assets embedded with analytics at various layers will bring in more intelligence to the system as well as through machine learning. As there is a gap in the market between very broad analytics technology platforms and customer expectations, there's a lot of work required to build analytic algorithms to address highly specific problems, especially in optimization of asset performance and energy efficiency. First, the biggest challenge lies in building a unique platform to aggregate the variety, volume, and velocity of industrial data and cleanse them before ingesting it into analytic engines. Second, the challenge lies in creating standardized pre-built analytic applications that are flexible, scalable and quickly deployable. This is significant as high implementation cost is the major roadblock in this transformative process. Finally, the focus is to create prescriptive insights collaborating diverse scientific, computational, and mathematical disciplines and business rules to predict business outcomes. It is going to be very interesting to witness how industrial customers are going to build business, whether to outsource managing analytic applications or to handle it internally with in-house expertise from centres of excellence.

50 billion devices will be IoT-connected by 2020. Intelligent sensors and networks will take measurement and control to the next level, dramatically improving productivity and efficiencies in production processes.

3. "As a Service" Cloud models

As Cloud computing enabled significant innovations in enterprise and consumer worlds, it's now time for the industrial community to witness the impact of Cloud services at the operational level, both in discrete and process based industries. This calls for the emergence of partnership ecosystems to offer holistic solutions that address emerging challenges of end customers. This means the need for an Infrastructure-as-a-Service (IaaS) model that enables industrial setups to concentrate on their core areas and outsource IT processes like storing, managing and securing massive industrial digital assets. Follow on with the IaaS in the industrial sector; it's the Platform-as-a-Service model that opens up significant opportunities and enables intelligent software applications. We must wait to see how combined expertise from IT and OT solution providers will come together to offer a holistic value proposition that makes industrial customers bet on this transformative approach and improvise their operations.

4. Industrial mobile apps and BYOD

The next obvious technology will be the market for industrial grade apps to address the emerging needs of mobile workers. The increased penetration of 4G-LTE infrastructure will tap the attention of industrial customers to demand mobile interfaces to improve anytime, anywhere response and collaboration. Moreover, the relentless consumerization of IT demands a solution to "Bring Your Own Device" (BYOD), where workers can use a handheld for personal and official activities while ensuring both parties are satisfied with security, usability and cost. The industrial automation market is a classic business case for devices that must bridge the gap between gadgets designed for the general consumer and purpose-built tools for the mobile worker.

5. Industrial cybersecurity

All the above technologies are at stake unless there is a robust back up from industrial cybersecurity systems and infrastructure. Industrial cybersecurity will have to move from a reactive operating model to a more proactive response model. Self-aware systems that can adapt and respond to different

levels of trust, decoy systems to gather information on an intruder in the network and defence-in-design are some of the foundational ICS cybersecurity solutions that underpin the growth of Internet of Industrial Things (IoIT) market. Higher levels of IT-OT integration will require appropriate skillsets and solutions that cater to cybersecurity incidents pertaining to ICS. While it is difficult to determine value versus ROI for industrial cybersecurity, damages and costs for repairs and revival after an attack continue to increase with APTs (Advanced Persistent Threats). With the increased ICS security offerings in the market and partnerships, we could see more initiatives from governments and industrial regulations to drive compliance guidelines, possibly for energy sector first and then for the rest influenced by the opening up of industrial network boundaries to the outside world.

Jim Pinto is an international speaker, technology futurist, automation consultant and writer.

1. Internet of Things (IoT)

The industrial Internet continues to transform the automation industry. It revolves around increased M2M communication with vast networks of data-gathering sensors, providing mobile, virtual, and instantaneous connection. The real value derives from the gathering data and leveraging it. More and more infrastructure is being put in place to analyze the data in real time. Cisco estimates that 50 billion devices will be IoT-connected by 2020. Intelligent sensors and networks will take measurement and control to the next level, dramatically improving productivity and efficiencies in production processes.Growth will be bottom-up, not top-down.

2. Mobile devices in automation

Today's pervasive smartphone has more power than a super-computer of just a couple decades ago. The use of Wi-Fi-connected tablets, smartphones and mobile devices is generating strong growth in industrial manufacturing. Handheld devices provide mobile access to real-time, actionable information to decrease costs, increase operating efficiency and enhance productivity. More engineering employees are working at different hours outside the factory. Many organizations are encouraging employees to use their personal mobile devices to access enterprise data and systems, a surprising and perhaps inevitable change in attitude.

3. Cloud computing

Cloud-based applications are the key to leveraging data for improved productivity. IoT doesn't function without Cloud-based applications to interpret and transmit the data coming from sensors, actuators and plant data from many different locations. The Cloud is what enables the apps to go to work anytime, anywhere. The Cloud helps to optimize operations by enabling collaboration among remote mobile workers and suppliers, allowing fast and secure access for data-driven decisions. Significant gains in efficiency, cost and capability can be achieved as more products become intelligent and Cloud-connected.

4. Smaller, cheaper sensors

Many conventional sensors are still too physically large and expensive, and this limits expanded use in IoT. Systems developers and manufacturers are looking for smaller, cheaper sensors — and they are getting smaller and cheaper all the time. As they do, they will increasingly be used in many intelligent devices. Added sensors and connectivity turn "dumb" products into "smart" ones, while products increasingly move into the realm of services. According to James Bailey of Accenture, "The cost of both the sensors and devices is approaching free and the size is approaching invisible. So, literally everything will have IoT technology at some point."

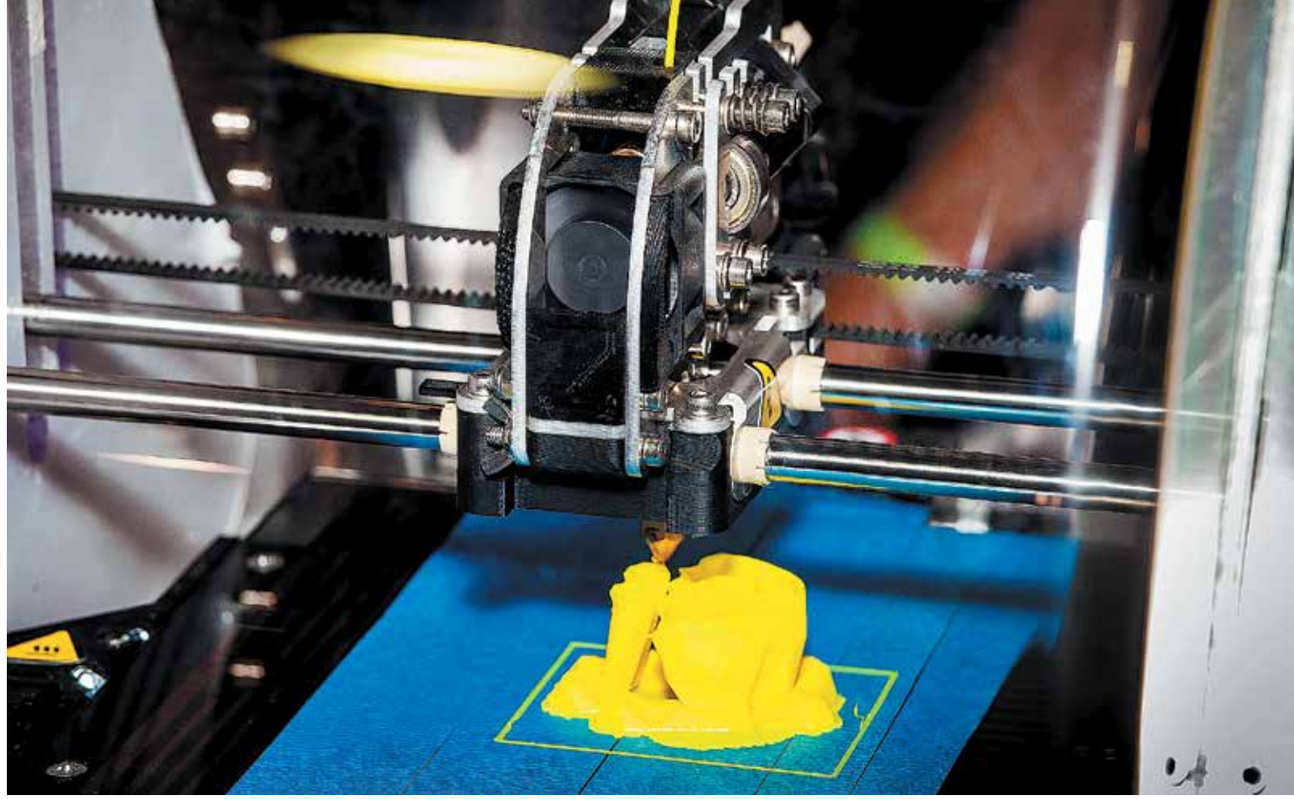
5. 3D printing in manufacturing

Today, manufacturing is becoming possible without tooling, large assembly lines or multiple supply chains. 3D printing is increasingly being used for competitive advantage relating to versatility, price and speed of delivery. The technology has developed to the point where it is opening up competitive manufacturing to small businesses. Accuracy is improving, the size of printed objects is increasing, and the price keeps reducing, so that 3D printing is expanding rapidly in the industrial manufacturing arena. It is surprising to think about manufacturing without tooling, assembly lines or supply chains. However, that is what is emerging as the future of 3D printing becomes commonplace.

Larry O'Brien, vice president of research at ARC Advisory Group, oversees research into process automation markets, including process automation systems, process safety systems, plant asset management systems, and field networks. He has been a member on several ISA committees and actively promotes technology standards throughout the process automation industry.

1. Industrial IoT-enabled applications for process automation

By connecting previously stranded data from smart sensors, equipment, and other industrial assets with advanced applications and predictive analytics in the Cloud, IIoT is becoming a strategic enabler to improve manufacturing performance. Despite initial concerns, many companies now realize that, when properly implemented, Internet and wireless technologies can provide appropriate security and availability of services across multiple plants and facilities. This helps further meld plant floor and enterprise systems, creating an opportunity to transform manufacturing operations through IIoT strategies. However, until clear standards and well-defined reference models emerge for IoT in process automation and the cybersecurity issue is fully resolved, many end-users are understandably taking a "wait and see" attitude.



3D printing is increasingly being used for competitive advantage relating to versatility, price and speed of delivery.

2. Modularization of automation solutions and production processes

Many industrial sectors have already embraced modularization concepts. NAMUR NE 148, for example, spells out how the chemical industry can use more modular concepts in automation and production processes to encourage reusable engineering and more flexible production. This includes use of innovative "plug and produce" micro production plants that can be easily relocated or reconfigured to different products as needed. Modularization also includes new forms of automation hardware like characterizable and configurable I/O and the "late binding" concept between automation system hardware and software to help get automation off the critical path for capital projects. With fully adaptable and standard I/O and control hardware, the user can theoretically design and test all of the software aspects of the system before it is deployed into the physical system hardware. Often referred to as "late binding," this allows the software to be deployed into the hardware infrastructure at the very late stages of the project.

3. Operator effectiveness and situational awareness

Many advancements have been made in HMI graphics over the past several years and you can see that in the new offerings from DCS suppliers. The most prominent example of this is the adoption of the ISA 101 HMI standard, which addresses both operator effectiveness and situational awareness. ISA 101 probably holds the record for the longest standard in development, but we have seen a lot of progress this past year, with its recommendations being implemented in several supplier HMIs.

4. Freeing "stranded" device diagnostics provides path for intelligent device management

Most intelligent field devices currently installed in process plants are "underachievers." They have a lot of untapped potential, but tapping into that intelligence and turning it into useful information has eluded many industrial organizations. This is not a question of which protocol to use, whether the devices are wired or wireless, or the kind of plant asset management system in place. The real issues are the day-to-day work processes that determine how maintenance and other tasks are completed in the plant. Preventive maintenance is still the order of the day, with maintenance technicians still travelling out to the field to inspect devices for potential issues. Intelligent field devices, however, offer the potential to change the way maintenance is done in process plants in some fundamental ways. In place of often-inefficient preventive maintenance rounds, real-time digital diagnostics from instruments and valves can

be used to schedule maintenance. This enables today's time-strapped maintenance staffs to focus on the devices and assets that actually require attention. In this manner, maintenance personnel can become more actively involved in optimizing the performance of the plant and operators are in a better position to prevent abnormal situations or shutdowns from occurring. The key is to have the right work processes in place for personnel to follow. ISA-108, an emerging standard, will provide end-users with standard templates for intelligent device management (IDM) work processes that they can deploy in their plants and modify to suit their individual needs.

5. New approaches for integrating automation and electrical technologies

Automation and electrification remain largely separate islands of functionality in today's plants, as are drives and motor control centres. Both process operators and maintenance personnel have limited visibility into what is really happening in their electrical systems and control over how much power their automation assets are consuming. Many suppliers offer applications for improved visibility into the power side of the manufacturing process. As reflected in our Collaborative Process Automation System (CPAS) model, ARC believes that taking a more proactive stance toward integrating the automation systems and electrical systems domains of the manufacturing process can yield significant energy cost savings. IEC 61850, a global communication standard for substation automation, defines the communication between intelligent electrical devices (IEDs) in switchgear and associated systems. This means that all automation functions, as well as the engineering, can be considered. The main point here is that IEC 61850 is the key enabler for integrating automation and electrical systems. By providing a greater level of interoperability between electrical devices from different suppliers, IEC 61850 does for electrical products what process fieldbus does for instrumentation and control valves. It also promises the same level of enhanced diagnostics and plant asset management capabilities offered in process fieldbus devices.

Andrew Hughes is a principal analyst at LNS Research with his primary focus being research and analysis in the Manufacturing Operations Management (MOM) practice. He has 30 years of experience in manufacturing IT, software research, sales and management across a broad spectrum of manufacturing industries.

1. Real IIoT applications

Much has been discussed about IoT in manufacturing and 2015 has seen the advent of viable first generation IIoT platforms that will allow enterprises to increase the value from their manufacturing assets and products. In 2016, we'll see the first real applications bringing together data from disparate sources to create knowledge that improves manufacturing. As an example, we can imagine an equipment supplier collecting performance data from many customers and applying it in your plant to improve line reliability and to predict maintenance.

2. Big data analytics

Manufacturing analytics is typically very fragmented. Edge analytics close to control level along with new mobile offerings brings new applications to the shop floor. Similarly, partnerships between automation suppliers and cloud computing companies offers big data opportunities beyond the plant. This year, we expect to see the first real big data analytics delivered to manufacturing companies. These will bring together manufacturing data with unstructured data and external information, and deliver new insights through sophisticated predictive and even prescriptive analytics results. The success of analytics in manufacturing will be directly proportional to the openness of engineers' minds to new knowledge; new smart connected business processes can come from anywhere.

3. Deconstructed MOM

Manufacturing Operations Management (MOM) systems have been around for almost 30 years and have steadily grown into huge monolithic systems that cover most, if not all, of the ISA95 MOM standard. These systems offer little flexibility. In 2016, we expect to see disruption in this sector from smaller applications that are integrated by IIoT platforms and Ethernet/IP to provide some functionality in the Cloud and some in the plant. Production execution and data gathering will remain in the plant while new applications for scheduling, analytics, visualization from anywhere, traceability and so on will become standalone Cloud applications, often offered as a service. Manufacturers will get more choice, less cost and tighter integration between plants.

4. IoT device gateways

Today almost all information gathered from plant sensors is passed up the chain from sensor to controller to HMI or MOM system and thus perhaps to a centralized repository. The IIoT needs to work in a very different way; access to sensor data that is not needed for control must be easily configured when it is required. New IoT gateways will provide low cost Ethernet/IP connections to the IoT platform and easy access to necessary sensor data without affecting control hierarchies. As IoT applications take off in 2016, device gateways will become an essential element of factory infrastructure.

5. IT-OT convergence

If the first four of my predictions come to fruition, then the fifth is guaranteed true! Plant personnel will see a huge increase of IT professionals wandering the factory floor. The convergence of IT and OT has been slow to get started, probably due to a mutual lack of trust, but now it is time. The opportunities for all involved are limitless as the gaps between plant and IT systems are covered over by IIoT platforms, analytics and MOM applets. All plant engineering staff should make it their 2016 New Year's resolution to become IT savvy! | **MA**