Technology Handbook

Digital supplement to
MANUFACTURING AUTOMATION

# MOTION CONTROL

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

ADVANCED MOTION CONTROLS | FESTO | HARMONIC DRIVE | JVL ... Integration in motion www.jvl.dk | LINTECH www.LintechMotion.com | POSITAL FRABA

ADVANCED MOTION CONTROLS
...driving the world's best robots!

# Motion control considerations for Robotics

by Karl Meier, Executive Team – ADVANCED Motion Controls

The rates at which physical robots are integrating into society today has increased so much that new categories are being created for their use and general purposes as well as dedicated designs versions compete for acceptability. The future of robots and robotics technologies is an economic area where it can be projected that new companies with new achievements will be some of the largest in the world in a short period of time. Intelligence is key to robots but what makes robots move so they can accomplish the activities they are designed to do is vital to their performance, and ultimately their existence. This brief article introduces the many aspects of motion control needing consideration when applying drive technology to robotic systems and platforms.

Any mechanical object that moves generally has a motor for operation. The electric motors incorporated into robotic designs are based on needed torque/force, speed and acceleration/deceleration parameters and are typically going to be either servos or steppers. In industrial robotics platforms, each motor selected will have a controlling drive that operates the motor to ensure required performance. By design and construction of each, servo systems are much more efficient than steppers and offer a much wider operating range. As servo drives are more widely used and accepted, the focus here will be on servo-based motion control.

Robots can have many different axes needing motion control and likely will include more than just main mobility of either propulsion or traction. For instance, there can be separate steering, arm extension/retraction, gripping, joint rotation, lifting, haptic feedback, etc. All of these functions usually incorporate a drive specifically tuned for that axis to provide the necessary controlled motion. The drives themselves receive commands from a supervisory controller that also maintains overall functionality of the entire system/platform. Motion control for the entire robotic system has traditionally been categorized into two areas: centralized or distributed.

A centralized control scheme requires the controller to continually calculate all torque/force, speed and position commands (called the control loops) for every axis, while simultaneously running complex programs that plan not only the motion profiles but also scan I/O or vision information to maintain complete robot operations. This can place a heavier burden on the processor(s) selected for use and may make the system unmanageable when increasing scalability.

In distributed control systems, motor control requirements are placed with the drives themselves and conducted over network communications where the controller merely monitors activities of the drives with limited computation needed. This allows the controller to operate more effectively and be more available for all other system functions. There are numerous networks to choose from as well as standardized function calls allowing motion control and system functionality to work very closely together. CANopen, EtherCAT, Modbus, Ethernet POWERLINK, PLCopen, etc. offer fully documented methods of getting up and running quickly and greatly reduce development time.

As robots need to manage on-board power as much as possible for continued operation, the choice for servo drives is wise as they are most efficient. This includes a power range from 10Watts to more than 50kW! However, and along with the servo motors, drives need to be 'sized' appropriately. Since the robot will have a pre-established voltage level available to the drives, sizing relates to being able to provide the minimum current required to allow the motor to maximize its abilities. As well, drives are offered in various platforms to include available back-plane mounted and PCB plug-in module versions, both with standard and extended environment capabilities. Custom designs are also available allowing robot OEMs to 'think outside of the box'. Custom engineered designs provide the prospect of achieving results not otherwise possible and often at costs less than that of off-the-shelf designs.

This information and insight has provided many industries with application excellence using servo driven robots and robotic platforms. For example: Material Handling's - Palletizers, Sorters, Automated Fork Lifts; Warehousing's - Storage & Retrieval Systems, Automated 'Pick & Present' Systems; Manufacturing's - Automated Guided Vehicles (AGV's), Transfer Lines, Assembly Cells; Medical's – Surgical, Scanning Systems; Homeland Security and Defense's: Unmanned Vehicle Systems (UVS's) for Air, Ground and Submersibles, Remote Control Detection; Service's – Telepresence, Inspection, Repair and Delivery.

Many more robots exist and many more are coming. Stay tuned to what the future holds…

ADVANCED MOTION CONTROLS
**ADVANCED Motion Controls®**
3805 Calle Tecate
Camarillo, CA 93012
Phone: (805) 389-1935
**amcleads@a-m-c.com**
**www.a-m-c.com**

ELECTROMATE
**ELECTROMATE**
6221 Highway 7, Unit #15
Vaughan, Ontario, L4H 0K8
Phone (905) 850-7447
**sales@electromate.com**
**www.electromate.com**



ADVANCED MOTION CONTROLS
...driving the world's best robots!

**Saving time, improving lives and keeping people out of harm's way.**

In automated storage

On the battlefield

In material handling

In extreme environments

In communities

In fabrication


*ADVANCED* **Motion Controls®** servo drives are specified & installed anywhere from factories and production facilities to extreme environments; from under the surface to the vacuum of space; from start-ups to multi-national companies; from security firms to national defenses and law enforcement agencies around the world.

*ADVANCED* **Motion Controls®** is the servo drive of choice!

Hundreds of off-the-shelf products and modified and custom solutions to meet your exact needs.

On the factory floor

In the operating room

In the warehouse

With telepresence

In the skies

On transfer lines


Designed & Built in USA

Camarillo, CA 93012
805.389.1935
a-m-c.com

ITAR REGISTERED

FESTO

# Function integration streamlines machine design, assembly costs

One of the tantalizing benefits of Industry 4.0 – the fourth industrial revolution now coming into focus – will be the ability for operators to break down production into semi-autonomous, self-controlling modules. This modular concept is about to become a practical approach in factory and process automation design. It won't work for all, but will enable many, irrespective of their size, to make significant improvements to their operational and business performance and customer relationships.

In a conventional plant layout using today's automation, control systems are highly centralized and changes of the unitary process sequence can be costly and time-consuming to execute. But a plant comprised instead of self-controlling production modules can be rapidly reconfigured for different products, sizes or packaging. Applying this "Lego principle" of modular automation can enable a producer to make small or highly customized batches of a product cost effectively, even batches as small as one. Modular automation captures savings in several areas. Operators can more effectively match production assets to fluctuations in demand. Only such modules as are needed to fill orders or meet operational demands are activated, rather than having to run an entire production line at sub-optimal efficiency. So modular automation is easier on energy and maintenance budgets. Breakdowns won't mean the entire operation shuts down. (This applies equally well in many process automation sectors, like food and beverage and pharmaceuticals production as well as utilities like water filtration and wastewater plants).The entire supply chain operates on a just in time basis, largely eliminating the need for maintaining large stockpiles of supplies or finished product. When the need for additional capacity arises, today's conventional approach is to add an entire production line, or even move to a bigger plant. With modular automation, capacity can be added incrementally, quickly and comparatively cheaply, by adding more modules. But the future of automation extends beyond modularity.

Industry 4.0, the Industrial Internet of Things, Smart Factory: Whatever you call it, they are basically the same idea: creating the cyber-physical plant where all machines and subsystems, even individual components, are linked to a digital, usually cloud-based, corporate IT structure. With so much more data being crunched, the system analytics will recognize inefficiencies or provide early warning about maintenance issues before they become more expensive to fix. And they will provide enhanced intelligence to help management make better, timelier operating and business decisions.

Industry 4.0 is a vision about to become reality. It's an evolutionary concept, a framework for the factory of the future. Ultimately, it will encompass many new technologies as they are commercialized, such as advanced robotics, high volume cloud computing, digital fabrication, and much more. Festo believes it's time for both the factory and process automation sectors in Canada to become conversant with how Industry 4.0 solutions might help their businesses. Festo is a leading developer of those technologies and concepts as well as some of the first Industry 4.0-ready components, like our energy efficiency module MSE6-E2M for compressed air monitoring. It can be employed on a standalone basis today and incorporated into an Industry 4.0 data network tomorrow.

Learn more about how the "Lego principle" – modular automation – can work by downloading Festo's modular automation whitepaper. It includes a case study for a modular water filtration plant with decentralized control using Festo valve terminals.

Click here to download Festo's modular automation whitepaper

FESTO
5300 Explorer Drive
Mississauga, ON. L4W 5G4
Phone: 1 877 GO FESTO
festo.canada@festo.com
**www.festo.ca**

You are looking for a partner who understands your objectives.
You require more efficient production systems.
We are your solution for automation.

→ WE ARE THE ENGINEERS OF PRODUCTIVITY.

FESTO

Increase the productivity and reliability of your production systems. How? It's easy: Get us involved in project engineering as early as possible. Our mutual dialogue results in process automation solutions which increase the safety of your systems and reduce your total costs of operation throughout the entire manufacturing process.

**www.festo.ca/ processautomation**

# Harmonic Drive LLC

**New series added to our Quick Connect® gearhead line**
Building a high precision actuator is easily achieved by coupling any servomotor to one of our precision Quick Connect® gearheads. Harmonic Planetary® and Harmonic Drive® gearheads are available with a wide range of gear ratios and torque capacities.

New HPN Planetary gearheads feature a robust design utilizing helical gears for quiet performance and long life. These gearheads are available with short lead times and are designed to couple to any servo motor with our Quick Connect® coupling. This new value series of planetary gears carry the reputation for quality and reliability for which Harmonic Drive® products are known throughout the world. HPN Harmonic Planetary® gears are available in 5 sizes, with reduction ratios ranging from 3:1 to 31:1.

HPG and HPGP Quick Connect® gearheads offer high precision and low backlash (standard: < 3-arc-min, optional: <1 arc-min). Harmonic Planetary® HPG gearheads are now available with helical gearing and low reduction ratios. The new models, HPG-[]R, add low-speed ratios from 3:1 through 10:1 including all integer ratios in between. Innovative ring gear ensures consistent, low backlash for the life of the gearhead.

CSF-GH and CSG-GH Quick Connect® gearheads with zero-backlash Harmonic Drive® gearing are available with high reduction ratios, 50:1 to 160:1. CSF-GH and CSG-GH utilize our proprietary S tooth profile and provide high precision positioning (repeatability ±4 to ±10 arc-sec). The greatest benefit of Harmonic Drive® gearing is the weight and space savings compared to other gearheads because it consists of only three basic parts.

Harmonic Drive gears and actuators are used in a wide range of applications, each taking advantage of the products high performance.

*Industrial Robotics*
These applications require zero-backlash with high torque, high torsional stiffness, and excellent repeatability. Harmonic Drive gears also feature hollow shaft designs, for easy, neat, and reliable cable routing.

*Medical Equipment*
Surgical robots require high-precision motion control. Harmonic Drive gears provide exceptional positioning accuracy. Other medical applications include CT machines, active prosthetics, laboratory automation and therapeutic equipment.

*Machine Tool*
Features valued by tooling manufactures are high-accuracy, compact form, and hollow shaft design. For example, CNC grinding machines require precision, repeatability, and zero backlash with superior dynamic transmission accuracy for smooth motion. Common applications for Harmonic Drive products include fourth and fifth axes of milling heads of machining centers and routers.

Harmonic Drive® Precision gearheads and actuators provide exceptional positioning accuracy and repeatability within a few arc-seconds and offer a wide range of reduction ratios in a single stage. Harmonic Drive gears provide zero backlash and have a long, maintenance free life.

*Electromate Industrial Sales is the exclusive Canadian distributor of Harmonic Drive products (except the Province of Alberta)*

Harmonic Drive and Harmonic Planetary are registered trademarks of Harmonic Drive LLC.

**HARMONIC DRIVE LLC**
247 Lynnfield Street,
Peabody, MA 01960
Toll Free: 800-921-3332
Phone: 978-532-1800
**www.HarmonicDrive.net**

ELECTROMATE
**ELECTROMATE INDUSTRIAL SALES LTD.**
6221 Highway 7, Unit #15
Vaughan, Ontario, Canada L4H 0K8
Phone: 877-SERVO98
Email: sales@electromate.com
**www.electromate.com**




## Permanent Precision, Excellent Backlash Stability

- Harmonic Drive® or Harmonic Planetary® gearheads
- Zero backlash and low backlash versions
- Ratios: 3:1 - 160:1
- Peak Torque: 3.9 N•m - 3940 N•m
- Sizes: 40mm - 230mm
- Output Configurations:

Hollow Shaft, Flange, Keyed Shaft, Smooth Shaft

Harmonic Drive LLC
247 Lynnfield Street
Peabody, MA 01960
800-921-3332
www.HarmonicDrive.net

Electromate Industrial
6221 Highway 7, Unit #15
Vaughan, Ontario, Canada L4H 0K8
(877) SERVO98 (737-8698)
www.electromate.com

Harmonic Drive®, Harmonic Planetary® and Quick Connect® are registered trademarks of Harmonic Drive LLC.
Electromate Industrial Sales is the exclusive Canadian distributor of Harmonic Drive® products (except the Province of Alberta).

# Industrial Ethernet Integrated Servo Motors

**Industrial Ethernet** is the name given to the use of the Ethernet network protocol in an industrial environment, for automation and process control.

A number of techniques are used to adapt the Ethernet protocol for the needs of industrial processes, which must provide real time behavior. By using non-proprietary protocols, automation systems from different manufacturers can be interconnected throughout a process plant.

Industrial Ethernet takes advantage of the relatively larger marketplace for computer interconnections to reduce cost and improve performance of communications between industrial controllers. Industrial Ethernet (IE) components used in plant process areas must be designed to work in harsh environments of temperature extremes, humidity, and vibration that exceed the ranges for IT equipment intended for installation in controlled environments.

JVL is a Danish company that specializes in Industrial Ethernet Integrated Servo Motors and Stepper Motors.. JVL is recognized as a world leader for its development of efficient and compact integrated motors for VAC and VDC operation.

JVL's MAC motor series of integrated servo motors include the controller, PLC, encoder, power supply and bus system integrated into one compact unit. All industrial Ethernet protocols like Profinet, EtherCAT, Ethernet / IP, Modbus TCP, Powerlink, Sercos III etc. are available. Furthermore, traditional modules like CANopen, DeviceNet, Profibus, Nano PLC, RS232/RS485/USB, Process Control can be incorporated.

## New Compact Motor

The MAC motor® series (up to 4500W and 13.5kW peak) sets completely new standards for the performance and size of integrated servo controls. With a length of only 182mm for a 1500W motor with a torque of 4.78/14.3 Nm at 3000rpm, this MAC motor matches the size of traditional servo motors without built-in controllers with flange 130x130mm. This has only been possible through the use of extremely compact motors and the development of electronics and mechanics that utilize the latest technologies and manufacturing methods.

So what about vibrations and temperature? As with the other JVL integrated servo motors in the range (50-4500W), both the motor and all electronic components have been specifically selected to withstand the rigorous demands required by industrial use.

## Power Supply and Energy Savings

Powering this motor is easy since it only requires connection of the main voltage of 3x400VAC through the M23 connectors. Control voltage for the encoder and microprocessor circuitry is 24VDC: In an emergency-stop situation, where an approved relay has cut-off the main power, encoder position and other values are maintained by this control voltage. Furthermore highly effective switching technology is used to ensure low heat generation resulting in appreciable energy savings.

## Other Advantages

One of the big advantages of using the integrated MAC motor® is that you don't need to install a separate servo driver or controller in a control cabinet. This gives you many subsequent advantages: Space savings in your control cabinet, saving of expensive motor and encoder cables, saving time (and money) for cabling, noise is minimized due to internal cabling and also installation errors between driver and motor are eliminated.

In addition, service is much easier, since the motor and controller can be replaced as a single integrated unit. Hence downtime is minimized and production is maximized.

## About JVL

JVL has more than 25 years of motion control experience and enjoys a reputation for the development of highly specialized integrated motors with industrial Ethernet and customized improvements. They work together with their customers and representatives to find an economic, yet technically advanced solution to complicated control applications.

JVL's wide selection of quality products for motion control components include: Integrated VAC and VDC Servo motors, Integrated Stepper motors, VAC Servo motor controllers, Motor drivers (Stepper, VAC and VDC), Brakes, Gears, and HMI Modules.

For further information, please contact:

**JVL Industri Elektronik A/S**
Bregnerødvej 127 DK-3460
Birkerød Denmark
Tel: +45 4582 4440
Fax: +45 4582 5550
**sales@jvl.dk**
**www.jvl.dk/**

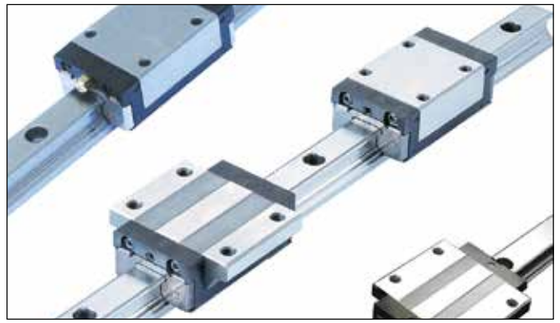
**ELECTROMATE**
6221 Highway 7, Unit #15
Vaughan, Ontario, L4H 0K8
Phone (905) 850-7447
**sales@electromate.com**
**www.electromate.com**



LINTECH®
www.LintechMotion.com

# Manufacturer of Mechanical Positioning Products:

For over 45 years LinTech has designed, engineered,and manufactured positioning components and systems for use in a wide range of Linear Motion Control applications. With our commitment to service, technical support, and quick deliveries, LinTech can provide you with a high quality product for your present, or future automation task. Located in Southern California, we pride ourselves on being able to deliver a high quality product in the shortest possible time.



## History:

Founded in 1971, LinTech started manufacturing single (SA series) and dual (TRSA series) linear precision shaft assemblies for the round rail market. Used in a wide range of linear motion manufacturing applications, these products led to LinTech's first standard screw driven positioning linear table in 1980. Since that time, LinTech has introduced over 17 other standard linear slides and linear actuators. Belt or screw driven, these linear stages can be interfaced to any step motor, or servo motor, system. LinTech is constantly designing new positioning components and linear slides for the many new application demands that are being created every day.

## Products - Standard Positioning Components:

Positioning components consist of precision linear shafting, shaft supports, shaft assemblies, round rail linear bearings, super ball bushings, pillow blocks, carriage assemblies, profile rail (square rail) linear LM guides, and ball screw assemblies. The cut-to-length, 1060 case hardened steel precision linear shafting is available in both Inch and Metric diameters with different Class tolerances. Class L, Class S, and Class N shafting is available. Shaft assemblies are provided in single and dual rail versions, with diameters from 0.5 inch (12 mm) to 2.0 inch (50 mm) and lengths to 192 inches (4800 mm). Open and closed linear bearings & pillow blocks are provided in both inch and metric sizes. Profile linear rails and linear guides are provided in three different model series.

Ball screw assemblies are offered in 3 different product groups - Rolled (RS series), Precision (PS series) and Ground (GS series), with and without pre-loaded nut assemblies. These ball screw assemblies provide the mechanical designer a finished sub assembly for their screw driven application. Each product group offers numerous diameters, leads, and lengths along with either simple, fixed or rigid end supports.

## Products - Standard Positioning Systems:

Linear motion positioning actuators, slides, stages and tables consist of a linear bearing and mechanical drive system (either a screw or a belt) into a finished product ready for the mounting of a motor & control system. LinTech offers several different linear stage models with load capacities from 1 lbs. (1 kg) to 16000 lbs. (7200 kg). With numerous options within every model series, these linear actuators are used in numerous applications.

## Products - Custom Positioning Systems:

Sometimes a standard mechanical assembly, linear slide, linear actuator, or positioning system is not the right choice for a particular motion control application. It may also be impossible, or not practical, to have the system built in house by your own design team. Let us take a look at your special requirements. We have been designing and building custom assemblies and positioning systems for over 45 years. We have the design engineering staff, a versatile machine shop, and the experienced assembly team to create that custom mechanical positioning system. We can use our many years of experience to help you select the right approach to a unique motion control problem.

LINTECH®
www.LintechMotion.com

**Lintech**
1845 Enterprise Way
Monrovia, CA 91016
800-435-7494
626-358-0110
**www.Lintechmotion.com**

ELECTROMATE

**ELECTROMATE**
6221 Highway 7, Unit #15
Vaughan, Ontario, L4H 0K8
Phone (905) 850-7447
**sales@electromate.com**
**www.electromate.com**



POSITAL
FRABA

# POSITAL Sensors and Mass-Customization – Get What You Need

Machine builders and system integrators face a constant challenge of finding compatible components for the equipment they are putting together. At POSITAL, our goal is to make our customers' lives simpler by helping them source rotary encoders, inclinometers and linear position sensors that are exactly right for their jobs.

POSITAL sensors are based on a modular architecture. Individual products are assembled on an as-needed basis from a set of standard components and sub-assemblies to meet customers' requirements in terms of performance characteristics (incremental or absolute measurements, range, resolution), mechanical features (materials, flange and shaft characteristics, level of environmental protection) and communications interfaces (analog, serial, fieldbus or industrial Ethernet ) and so on. This approach, which POSITAL refers to as "mass customization" makes it possible for customers to receive products that are tailored to their specific requirements, quickly, and prices comparable to standardized mass-produced items.

**Putting the customer in control**

The front end of this system is the company's web-based Product Finder tool which provides access to over a million possible product configurations. Customers and value-added distributors can 'build' sensors that meet their requirements by selecting from a menu of the features and characteristics. The product finder system will confirm that this configuration is feasible and provide a part number, data sheets and product drawings in CAD format. The distributor can then request the products from the manufacturing support system, with fulfilment usually occurring within a week.

**Data Centered Manufacturing**

At the center of the company's approach is a data-driven manufacturing support system that controls each step of the production cycle. The manufacturing support system receives orders and provides the assembly technician with a bill of materials and a complete set of assembly and testing instructions. Once a device has been assembled, it is calibrated and subjected to a full set of QA tests. Assembly records and test results are stored in the production database so that each device's history is entirely traceable.

**Programmable Flexibility**

POSITAL has taken the data-centered approach a step further by making their latest generation rotary encoders field-programmable. These new-generation devices incorporate embedded microprocessors and specialized signal processing software. Performance characteristics such as measurement range and resolution (number of steps per turn) can be modified through software updates, without requiring any changes to mechanical components. This results in a significant increase to the versatility for end users. Distribution partners also benefit from this innovation since it means that they can offer a wide range of product configurations without having to stock a large range of physical units: individual devices can be customized through quick and easy software updates.

POSITAL sensors are covered with a 3-year-warranty.

POSITAL-FRABA CEO Christian Leeser describes the advanced manufacturing system behind these new-generation sensors.

LINK TO VIDEO

POSITAL FRABA

**POSITAL-FRABA Inc.**
1800 East State Street, Suite 148
Hamilton, NJ 08609, USA
Phone: 609-750-8705
info@fraba.com
**www.posital.com**

ELECTROMATE

**ELECTROMATE**
6221 Highway 7, Unit #15
Vaughan, Ontario, L4H 0K8
Phone (905) 850-7447
**sales@electromate.com**
**www.electromate.com**



POSITAL
FRABA

PROGRAMMABLE INCREMENTAL ENCODERS

**Find the Right Position and Motion Control Sensors for Your Application**

POSITAL's outstanding range of mechanical configurations and programmable performance make it easy to get exactly what you need.

At Your Fingertips
1,000,000
Sensors

**www.posital.com**

# PUMP UP YOUR PRODUCTIVITY

## Modification of motion control products can provide safer, more efficient operations

BY SHANNON WINKLER

The automation industry runs smoothly, effectively and efficiently when the right motion control products are employed on operating equipment. There are four important considerations to take into account when evaluating customized motion control solutions. Plant operators and management should consider the four points below when evaluating motion control products for a facility.

### 1. EMPLOYEE SAFETY

The primary purpose of motion control technology is to decrease human intervention during mechanical and machinery operation. Work-related musculoskeletal injury is often reported when working in a manufacturing environment. Introducing and continuously using motion control products in any workplace results in little to no strain or bodily injury. With fewer hands-on steps in manufacturing processes, employees no longer have to put themselves at risk while working to maintain productivity of a facility. Once motion control products are introduced, plant managers should expect to see a significant decrease in workplace accidents. This is a positive benefit to share with all plant employees.

An automotive steering and suspension component company in Ontario requires the movement of 2,300 F billets through numerous processes in a work cell. The heat in this environment is, of course, too extreme for humans to work. An industrial process company provided the component company with a custom-engineered motion control solution. To limit contact with this dangerous environment, a compact automation angual motion gripper, attached to arm tooling on an ABB robot, was selected. The grippers move the billets from the heat station, to the roll station, to the bend station and finish at the press station. These are critical process steps for these parts. The grippers play a very important role in moving the parts from station to station accurately and consistently while meeting the drawing specifications.

There are numerous advantages to the company such as:

- Ensuring human/employee safety – Automation machinery eliminates worker injuries during dangerous tasks in dangerous environments.
- Production and productivity – Increased product production with higher volumes at lower cost in less time than other types of machinery or if completed by humans.
- Quality – The automation grippers are consistently accurate and provide repeatability that is otherwise unobtainable due to human error.
- Lean and savings – Return on investment (ROI) is immediately impacted after this type of machinery is implemented. There is a reduction in waste, due to the ability of the motion control products to produce more of the product, while accumulating less scrap.

There are more financial savings, including the elimination of workers compensation due to employees avoiding unsafe environments that may cause worker injuries.

### 2. COST

Particularly when it comes to purchasing a new product, automation customers are instinctively looking to reduce costs and maintain profitable operations. Although a custom-designed product may require a greater initial investment, purchasing the right solution can save money in the long run. A customized motion control product can be developed to meet the unique motion control specifications of almost any application.

Customers often select a product because of its lower cost, but if it's not designed for that specific automation application, side load or other improper loading could be induced. This can cause disruption in production and possible damage to the equipment resulting in expensive repairs and unplanned down time. Evaluating a potential purchase based on a total cost throughout the life cycle of the product may result in substantial savings. Partnering with a custom-engineered solutions provider will ensure that the right product is being selected based on budget, needs and the unique specifications of the facility.

### 3. EFFICIENCY

The automation industry is commonly centered on a goal of maintaining consistency and efficiency. The use of automated machines removes the possibility of slowing down a process, or causing any imperfections in the product due to human error. Machines perform the same tasks with the same steps in the same amount of time every time. These automated solutions are useful when production needs are constant. However, custom-engineered motion control products allow a plant manager to speed up or slow down a machine's production as needed to accommodate fluctuating supply and demand.

### 4. QUALITY/RELIABILITY

When searching for a motion control product, overall quality and reliability should be a main concern in the decision-making process. The average off-the-shelf model can have shortcomings in either area. For example, cylinders used in machinery are designed to operate within a certain speed of travel. Using a cylinder at its top speed or beyond its intended use will cause premature machine failure. However, a custom-engineered motion control product can last up to 10 times longer when it is designed for its specific function and environment. Toxic or acidic washes, extreme heat or cold and production speed are all factors that may shorten a product's life cycle if not properly designed.

**Which consideration is the most important?**

Although each of these four categories should be heavily considered throughout the selection process, ideally employee safety should be the top priority. However, the overall cost of the product plays a large part in the final decision for plant managers. Be sure to first look at the length of a product's life cycle, rather than the initial cost before selecting a motion control solution. Financially, custom-engineered motion control products will ultimately be the best choice in the long term, due to their ability to work in hazardous environments and achieve high efficiency levels while maintaining quality and reliability.

Since the automotive component company mentioned earlier is experiencing the many benefits of motion control products, imagine what this technology could do for your plant. Motion control technology can increase the safety of your employees and limit the dangerous contact of those who may be subject to hazardous working environments. The technology can increase and speed up your facility's production while delivering high-quality, consistent product at reduced costs. And if your supply and demand fluctuate, your plant manager has the flexibility to speed up or slow down production, as needed. While the financial savings are best seen over the long-term, your plant will still benefit from an almost immediate return on investment, reduction of waste and increase of employee safety. | MA

Shannon Winkler is the product manager with ITT Control Technologies. His responsibilities include managing customer service and application engineering.


A collection of demo equipment, including PLCs, RTUs, telemetry radios, VFDs and process analyzers, at True North Automation's lab for bench-testing developments for clients.

PHOTO: TRUE NORTH AUTOMATION

# LESSONS LEARNED

## How to avoid pitfalls and make the best decisions in automation

**BY TREENA HEIN**

Over the past 25 years, many companies in Canada and beyond have learned the hard way that automation must be implemented carefully. Done the right way, it can save costs and optimize processes directly and indirectly, boosting profits and opening new markets. Poorly-executed automation can cause a wide range of headaches and also create new ongoing issues that never existed before. So, although everyone knows that decisions surrounding the automation of a process — or the upgrading of systems that already exist — must be made with care, what exactly does that mean? *Manufacturing AUTOMATION* talked to two experts about how best to navigate the minefield and come out ahead.

First, let's review reasons to automate in the first place. "Yes, automating saves labour costs, but it comes with costs for energy, programming, maintenance and more," says John O'Rourke, president and CEO of Sigit Automation in Calgary, Alta. "You should think carefully about how you might partially automate or make other changes before you automate that can save you substantial costs." O'Rourke gives the example of putting the right equipment in the right areas. "In many plants, there are zoned 'explosion areas,' and if you can change things in that area, the area can be de-zoned," he says. "Then you are free to use reduced-costs machines in that section and carry out processes more efficiently."

Cost savings aside, automation is also put in place when there is no choice — when a task either can't be done manually, or the quality, repeatability and reliability required can only be achieved with automation.

Lastly, automation is done for safety reasons, notes Christian Schacher, integrated solutions manager at True North Automation in Calgary. "If you automate the monitoring of critical processes, equipment will automatically shut down when it should," he says. "An operator or even a team of them cannot be constantly checking a process to make sure it's within limits." He adds that automation is also used to restrict access to areas or work cells to protect people's safety.

If the need for automation is clear, here are some factors to consider to make the best decisions possible.

### *First analysis*

"Most customers don't understand their needs and this is the critical first step," O'Rourke says. "I've seen consultants over and over steering customers towards their own comfort zones and the project ends up being over-automated or under-automated. We can automate anything you want, but is it practical?" He says the first step any reputable automation firm should take is a thorough exploration of the client's wants and needs, followed by a session where the firm explains that back to the client. "They have to know we are listening and they themselves need to understand their own situation," O'Rourke explains.

### *Keep it simple*

The solution to meet identified needs should be as simple as possible, in O'Rourke's view. "Over-automating and over-engineering is a costly mistake," he says. "We only need to solve the problem."

### *Bridging the gap*

You just can't build something and leave, stresses O'Rourke. "Your automation firm has to bridge the gap from engineering to operations and maintenance," he says. "It's critical to make sure there will be no gaps at the end of the day."

### *Painstaking cost analysis*

O'Rourke advises a full exploration of the costs of each automation option. "Design and install is one thing, then there are ongoing costs," he notes. "For example, once you get into automated data gathering, what are you going to do with the data? What are the costs with data storage and analysis and acting on that analysis? Ongoing programming fixes are another cost. The programming should not be so complex that you only have one person to call who can fix it. This scenario happens more often than you might think."

### *Avoid vendor/hardware bias*

Schacher points out it's very easy for an automation firm's staff to become complacent and simply suggest the control system platform they are most comfortable with, rather than analyzing the situation and suggesting a true 'best-fit' solution. "We've had clients south of the border relying on us for their control system design, and we were considering hardware that we're familiar with," he says. "That hardware was proven in Alberta, but we realized we needed to pick something they are used to there. It's up to the automation firm to understand how a system that's best for the client works when we're not familiar with it. It's our responsibility to take on that burden, that learning curve."

Schacher also notes there are several popular supply brands for main automation systems but that there are many specific process situations in manufacturing where there are hundreds of solutions — and the expense of a big brand can be avoided.

### *Serviceability and obsolescence*

Automation systems must also be serviceable by local companies. In addition, parts for older systems will become impossible to purchase at some point in time, and Schacher says it's another responsibility of your automation firm to know what's being phased out. "There are systems still in use from the late 1980s when automation was taking off, and they're obviously very rugged and dependable, but the hardware and software is just so outdated that they're now being phased out," he says. "It's up to us to know these things and forewarn the customer when they only have a few years left with this tech, and ask if they have considered a migration strategy. This is becoming more important all the time."

Schacher remembers one customer in such a bind to find an outdated replacement component that staff had to try eBay. "What we want to avoid is the failure of a critical component that has become scarce or obsolete, which would result in extended downtime," he explains. "You need a migration strategy, where you have a planned switchover to a new system. You may be down a week while you migrate, but it's preferable to having no replacement parts and potentially being down much longer."

Overall, a migration strategy involves deciding to preserve as much of the original program code and hardware as possible, or starting from scratch. Schacher says this decision is affected mainly by customer comfort level and cost. "It's up to the automation integrator to demonstrate the tremendous value that can be realized from a complete rebuild," he explains. "The audit process in preparation for a migration includes the system architecture diagrams, shutdown keys, control narratives, instrument indexes and control system drawings, which are all especially valuable to an older facility where they may have lost confidence in this documentation over the years."

Schacher usually favours going with a completely new control system because of the way it can help optimize plantwide processes. "New software platforms also allow for more flexibility and easier troubleshooting," he adds. "And newer systems can interact with a wider range of end devices."

Modern control systems are also built in a modular fashion, which makes them highly flexible and of course, scalable. "The need to expand is very common, so you want to be prepared to do that," Schacher says. "With an older system, it's so much harder to integrate hardware additions."

### *Concluding thoughts*

In the end, O'Rourke believes the more people you can bring in for their views and opinions, the better. "IT personnel have their perspective on networked systems and integration, programmers have theirs, maintenance have theirs, and so on and so on," he says. "Getting everyone's input and perspectives from all angles will go a long way to helping you make the best decisions."

Schacher agrees. "Integrators (automation firms) need to understand a bit about everything," he says. "It's our responsibility to see the big picture. We're usually the last ones remaining on site to commission a plant, so we need to be able to identify any design shortcomings ahead of time. When not everything is taken into account in the upfront design, we are faced with a lot of decisions, and companies need to understand there is sometimes no way to fix a poor design with more automation. It might have to do with improper sizing of some process component or misuse of a machine function, and simply adding a timer or trying to change the function just won't help. Sometimes we have to take a step back and have the other engineering disciplines re-look at their design. We have to have that hard conversation." | **MA**

Treena Hein (treenahein.wordpress.com) is an award-winning Ontario freelance science and tech writer.

# DON'T MISS OUT

on your next issue of

# MANUFACTURING AUTOMATION

## IT'S FAST, IT'S EASY AND IT'S FREE!



## HERE'S HOW:

FOR FASTEST SERVICE VISIT
AutomationMag.com
AND CLICK THE
SUBSCRIPTION BUTTON

AutomationMag.com