

MOTION CONTROL

A LOOK INTO THE PRODUCTS,
TECHNOLOGIES AND SOLUTIONS
SHAPING THE MARKET

DIGITAL
SUPPLEMENT TO

MANUFACTURING
AUTOMATION
MACHINE DESIGN • SYSTEMS • TECHNOLOGY

Servicing Industry for over 25 Years

In 1988 things were much different. We communicated primarily through phone and fax, teletype machines still haunted a corner of the office but were rarely used. PLC technology was growing exponentially and microprocessors were creeping into many aspects of automation. Communicating primarily with Email was just a notion that seemed to be many years in the future.

It was in 1988 that A-Tech Instruments Ltd was formed. As a manufacturer's representative, the new company would supply physical measurement equipment to the automation industry as well as to aerospace and research.

Based on the principles of engineered technical sales, A-Tech's objective was to provide customers with an alternative to buying their measurement systems as components and assembling the measurement chain themselves. Starting with a couple of key manufacturers it was soon evident that A-Tech Instruments was to become a success.

Using experienced technical sales representatives, they provided their customers with a complete measurement solution from sensors to cables to conditioning to data acquisition.

New partnerships with manufacturers were established over the years and now the company has a well-rounded product offering for manufacturing automation. Most measurement challenges could be solved by dipping into A-Tech's toolbox. A service and manufacturing department grew around customers' needs for a complete solution. Today, 25 years

later, A-Tech Instruments is a leader in the industry with a competent staff and a comprehensive lineup of products.

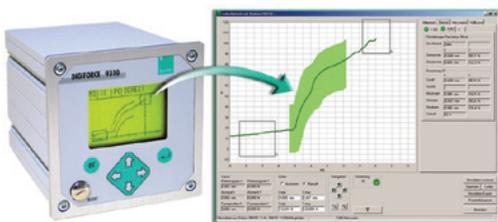
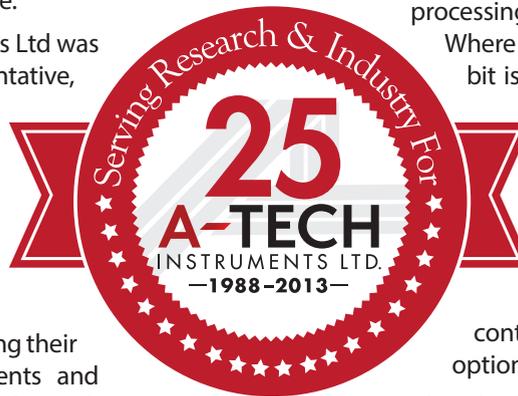
Sensor technology has evolved in many areas over the last 25 years, although the basic principles of converting a physical item into an analog signal has been fairly constant, the conversion from analog to a digital value and the signal processing, has seen an incredible evolution.

Where 12 and 14 bit A/D's was common, now 16 bit is the norm with some systems boasting 24 bit A/D with DSP (Digital Signal Processing). Moving this digitized data around has become lightening fast with a broad range of field bus and Ethernet options including wireless transmission of signals. A good example is the Burster 8661 contactless rotating torque sensor with option for USB connectivity.

When looking at Press Force monitoring, Torque to Turn or Functional Testing, A-Tech Instruments has a variety of solutions and the staff to assist in making the right choice.

One of the dominate manufacturers of instrumentation for automated processes is Burster, with a range of products that includes sensors, signal conditioning and signature analysis instruments. The start of any measurement chain is the sensors and selecting the correct Burster sensor is easy as there are a variety of styles with a large number of force ranges.

The conventional Hydraulic Press is typically used for Press Fit assembly processes and 100% process monitoring is almost always incorporated with a Press Force Monitoring Controller.



A number of instruments with a variety of features can be selected for most of the standard applications with data display, acceptance limits, tolerance windows, etc., to the complex signature analysis of the more advanced functional testers with graphical displays. The configuration and data storage software makes these systems intuitive, easy to use and incorporates 100% data collection.

In 2013 Burster has introduced the 9110 as a compact system with capability to perform press force monitoring on small machines or hand presses that compliments its very successful 9310 and 9307 Digiforce units.



Where a process requires finer control, A-Tech Instruments offers the Coretec line of Servo Presses and Nut Runners. These actuators were designed not only as a rugged assembly tool, but they also incorporate onboard sensors and monitoring software for 100% on-line quality checking.

With this broad range of products and years of experience A-Tech Instruments Ltd. Is the "go to" source for assembly and process monitoring.

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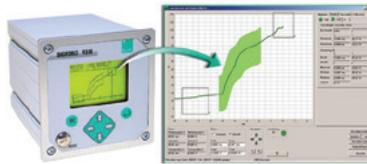


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- Large selection – nine models in travel and accuracy



The Planar_{DL}-200XY and -300XY stages are both available with one or two motors per axis, allowing optimization of each individual axis for the specific application and process parameters. Regardless of the number of motors selected, the resulting drive force acts through the centers of friction and stiffness resulting in superior geometric performance and accuracy.

Aerotech's Planar_{DL}-series stages offer excellent geometric and dynamic performance in a compact, low-profile and cost-effective package. Available in nine different travel and performance configurations, this stage is the ideal solution for applications ranging from high-accuracy surface profilometry to high-speed semiconductor and LED wafer scribing.

Superior Stage Design

With an optimized structure, components with exacting precision, Aerotech's own direct-drive motor technology and an integrated cable management system, the Planar_{DL} debuts as an industry leader in planar performance.

The Planar_{DL} XY design allows for unparalleled planar geometric performance in applications where straightness and flatness of motion are critical. High-precision, anti-creep crossed-roller bearings, precision-machined surfaces and Aerotech linear motors driving through the axes' center-of-stiffness result in exceptional geometric tolerances.

Planar_{DL} structural elements are optimized for high-dynamics and high-stiffness for the most demanding dynamic applications. Capable of achieving 1 m/s velocities and 1.5 g accelerations, the Planar_{DL} enables high-throughput, high-accuracy processing resulting in superior process yield and a low total cost of ownership. Unlike competitive products using recirculating bearings, the anti-creep crossed-roller bearings used in this design provide the smooth motion ideal for the most challenging scanning applications.

Noncontact Direct-Drive Technology

Only noncontact, direct-drive technology offers high-speed and accurate positioning coupled with maintenance-free operation and long service life. At the heart of the Planar_{DL} is Aerotech's proprietary direct-drive technology. This drive technology allows for unmatched performance compared to other competitive screw-based and linear-motor designs.

Integrated Cable Management

The cable management system on the Planar_{DL} is integrated into the stage and optimized for long life and performance. Additional standard options are available for extra servo axes or air/vacuum lines for vacuum chucks or other process pneumatics.

Extreme Positioning Performance

The Planar_{DL} is available in three positioning performance options: -BASE, -PLUS and -ULTRA. Relying upon decades of experience in system-level design including not only positioning mechanics, but also software and electronics, Aerotech has developed advanced technologies to push the envelope of precision. High-performance -PLUS and -ULTRA options are available to enable accuracies and straightness values down to $\pm 400 \text{ nm}$ and orthogonality down to 1 arc second.

For further information, please contact Aerotech at 412-963-7470 or sales@aerotech.com. In addition, more information on the Planar_{DL} is available at www.aerotech.com.



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New motion control system options utilizing EtherCAT® technology

Servo-based motion control systems have traditionally been categorized into two types: centralized or distributed.

Centralized systems use dedicated motion control cards that account for all aspects of the system including servo commands, motor feedback and I/O to close all control loops while simultaneously running complex programs that plan motion profiles and maintain machine operations. Increasing the number of axes involved places an ever increasing burden on the processing power of the DSP quickly making the system unmanageable simply due to scalability.

In distributed systems, motion commands are less complicated since the drives close the velocity and/or position loops internally leaving the controller to focus on motion profiling, planning and associated I/O. However, limitations arise as communications speed may be the limiter of some specific motion and machine requirements. Even though systems can be made to be deterministic, the ability to keep up with demand can also be a challenge, even for simple machine tools.

Is there a solution that combines the speed of centralized control with the scalability of distributed systems? ...Enter the Age of Motion Control via EtherCAT.

The latest evolution in motion and machine control is EtherCAT, taking into account centralizing machine control but leaving motion control distributed. This brings together the best of both worlds. In fact, CANopen over EtherCAT is easily implemented and is gaining more and more traction every day.

EtherCAT overcomes Ethernet's system limitations by processing frames 'on the fly' so data packets are no longer delayed at every node. Packets are processed in each slave node addressed to it while being forwarded to the next device. Similarly, input data is inserted while the frame passes through and therefore only delayed by a few nanoseconds. Data transfer to the master controller is via direct memory access (DMA) so no processor capacity is consumed for network access. EtherCAT network configurations support almost any topology while being completely flexible - line, tree, star or variations of each are not a problem. In fact, provision for cable lengths of up to 100m between devices is possible

and network size is almost unlimited (up to 65,535 devices can be connected).

Given this, EtherCAT achieves performance not realized by other networks. The update time for 1,000 distributed I/O points is only 30 μ s. Almost 12,000 digital inputs and outputs can be updated with a single Ethernet frame and only take 300 μ s for data transfer. If that wasn't fast enough, now comes the amazing part - communication with 100 servo axes only takes 100 μ s, faster than most centralized control systems for a single axis!

As amazing as EtherCAT is, ADVANCED Motion Controls has taken further steps to achieve yet new levels of capabilities. By leveraging the system's overall flexibility and maximizing potential performance, recently introduced are DxM™ and DxI/O™ (Demultiplexed Motion and I/O) technologies by the company. Now a single EtherCAT node can accommodate a combination of up to 4 axes of motion, 128 digital inputs, 128 digital outputs, 16 analog inputs, and 8 analog outputs or 70 I/O points per axis!

Typically, EtherCAT systems have been on larger machines such as printing presses, packaging lines and large in-place robotic systems that can accommodate sizeable control systems enclosures. With ADVANCED Motion Controls' DxM™ and DxI/O™ technologies, application solutions are now available for smaller machinery and desktop equipment like water jet cutters, routers, lab automation equipment, biotech processing equipment, smaller mobile robots etc. where panel space is a premium or not at all available.



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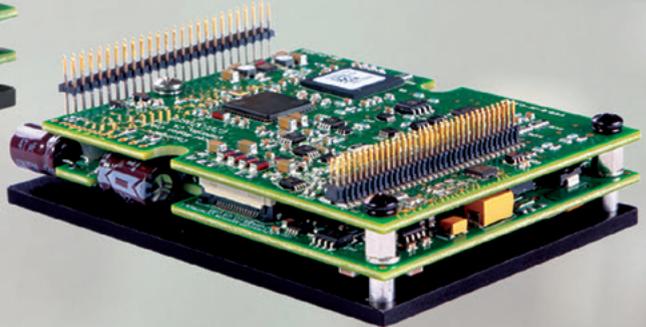
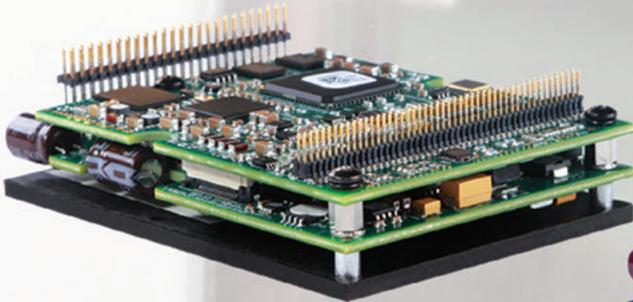
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GALIL MOTION CONTROLLERS SUPPORT CLOSED LOOP STEP MOTORS

Two types of electrical motors are used extensively in automation applications: step motors with open loop operation and servo motors with incremental or absolute feedback. The first type of application requires the motor to reach final position and hold the position. Low cost step motors are typically used because feedback is unnecessary, and with current kept constant through the phases, step motors hold a position with a fairly high level of static torque. The second type of application requires accuracy and smoothness during the motion as well as at the final position. For this application, higher cost servo motors are used with either analog or digital feedback, where the motion controller provides a PID filter or something similar for accuracy at all times.

Over the years, applications have begun demanding positional accuracy from step motors, resulting in the use of half, quarter, and microstepping motion. In these modes, current is regulated between phases to hold the motor at a target position. This method works well with half, quarter, and eighth

stepping, but microstepping with higher resolutions become harder to hold position without a feedback device for confirmation. Feedback devices were added to the step motor to achieve the higher accuracy, allowing users to access true motor position. This resulted in the need to then close loop around the feedback to maintain accurate positioning.

Galil controllers support closed loop step motors both for applications using Galil's internal drivers or those using external 3rd party drivers. Galil's internal drivers control the 2-phase motor similar to the way a three phase brushless servo motor is controlled, commutating the motor using position feedback. For driving a stepper motor with an external drive, Galil's controller requires position feedback to close the loop and outputs step and direction pulses to control the amplifier. External drivers provide greater design flexibility but increases the system wiring and the real estate space of the overall motion control system.

Please contact a Galil Application Engineer to review which option will work best for your system.



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Robotic snake-arm flies into tight spaces

A robot as agile as a snake can explore almost any hidden nook and cranny. Problems often occur in confined and hazardous spaces, and whilst these spaces are difficult for humans to work in, a snake-arm robot has no issue. Whether in aircraft assembly, nuclear power stations or the inspection of sewage systems: maxon motors are responsible for the high-precision movements of the multiple degree-of-freedom robotic snake-arm.

Just like in a science fiction film, the robotic snake-arm wriggles through a small hole. Its task: to perform a safety inspection in a hard-to-reach location, recording video as it does so. Very confined and hazardous spaces are common in many industrial sectors. Small spaces are not only difficult for humans to access, but these areas and the devices they contain also have to be inspected frequently. OC Robotics, based in Bristol (UK), looked at the world of animals for inspiration and developed the “snake-arm robot”. Managing director Rob Buckingham and technical director Andrew Graham developed the first prototypes in 2001. They have continued to this day to perfect the technology behind the snake-arm robot. The company was founded in 1997 and manufactures snake-like robots that are especially suitable for confined spaces and hazardous environments. The snake-arm robots have a slim, flexible design - they can easily fit through small gaps and circumnavigate obstacles with great skill.

Snake-arm robots have been used in aerospace assembly, in the nuclear energy sector, in medical technology and in security applications. Depending on the customer’s requirements, the snake-arm robot is available in different lengths and diameters. The standard sizes vary from 40 mm to 150 mm in diameter and have a length of 1 m to 3.25 m; if required, lengths of up to 10 m are possible, or diameters down to 12.5mm. The diameter of the snake-arm determines its functionality - the larger the diameter, the more weight the robot can lift.

Each snake-arm is customized specifically for the respective application. Furthermore, the “head” of the snake-arm robot can be equipped with various tools. OC Robotics offers tools for visual inspection with appropriate lighting and cameras, special gripper jaws or lasers for cutting metal and concrete (see video). Depending on the application, the snake-arm robot can be mounted on a stationary or mobile station such as an industrial robot or a gantry.

Always following its nose

The snake-arm is capable of performing a whole range of inspection and maintenance tasks, without any direct support from its environment. It can be navigated freely across open spaces. The robot is controlled by means of proprietary software which enables the operator to control the snake-arm by means of the “nose-following” principle. A command is transmitted to the tip of the snake-arm by means of a joystick and the rest of the joints follow this specified path.

In other words, if the operator steers the tip clear of an obstacle, the rest of the snake-arm will follow suit. With this technology, it becomes a lot easier for people to work in hazardous environments, yet humans are not eliminated completely, explains Rob Buckingham, managing director of OC Robotics.

Brushless maxon DC motors for flexible movements

In a human arm, the tendons connect the muscles to the bones of the joints. Similarly, in the snake-arm robot, stainless-steel wires are connected to the individual joints of the robot like tendons. Each individual wire inside the snake-arm is connected to a maxon motor. The snake-like wriggling movements are the result of the motors transmitting the mechanical power to the snake arm, where the individual joints of the arm are located. Depending on the version, up to 50 maxon motors are installed in each snake-arm. These are not located directly in the arm, but instead in an actuator pack in the base of the robot. This is advantageous as the electronics are more easily accessible and not exposed to the confined and hazardous environments. Another area of use for the motors is the different tools for the snake-arm’s head. Here, one or two maxon motors are responsible for the movements of (for example) the gripper jaws or swage tool.

The biggest challenge to the drives is that they have to provide a high enough power output inside a compact design. Therefore, the brushless maxon EC-max 30 DC motor (60 W) and the ceramic version of the GP32 planetary gearhead are used for this highly complex application. Thanks to the brushless design, the electronically commutated DC motors are excellently prepared for long operating times. The heart of the maxon motors is the ironless winding - with the benefits inherent to the physical design, such as zero cogging torque, high efficiency and excellent control dynamics.

Special modifications were necessary for the motors used in the snake-arm robot. A special cable and fastening holes were required, whilst the maxon motor planetary gearhead was modified for the application and a special housing was developed for the brake. For OC Robotics, the reliable motors, good customer support, high quality and high power density were the decisive criteria for choosing maxon motor.



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Scaleless SL Motor: Linear Motor with Built-In Encoder

RADFORD, Va. — For years, engineers have known that converting their linear motion system from a rotary-to-linear transmission system to a direct drive linear system will increase its reliability, precision, and power efficiency. The main issues that have prevented this switch were cost and complexity. Nippon Pulse has just released their new Scaleless SL Motor (SL083), which addresses both of these issues while also opening up a whole world of new possibilities.

The Scaleless SL Motor is a tubular linear motor with a built-in linear encoder. The simple design features just two parts, the shaft (magnets) and forcer (coils). In addition to the coils, the forcer also contains the integrated linear encoder and hall sensors. The stainless steel shaft has the scale for the linear encoder integrated into a single unit.

Unlike many linear motors that add analog halls and call the resulting noisy, large pitch sine wave an “encoder output”, the new Scaleless SL Motor has built in a real SIKO magnetoresistive linear encoder.

By integrating the encoder into the linear motor, the cost is far lower than the combined cost of the linear motor and encoder. In addition, by using a real encoder with incremental line driver output for real time data interpretation, there is no need to buy an expensive, proprietary servo drive. The Scaleless SL Motor

functions with any commercially available servo drive, thus allowing you to employ the best servo drive for your application.

Having the encoder integrated into the linear motor also simplifies the design and build of the system. There is no need to figure out where to install a separate linear encoder. Let us look at one example:

The Scaleless SL Motor is non-contact. Since the coil completely wraps around the magnets, all of the magnetic flux is efficiently used. This allows for a large 0.5 mm nominal annular air gap that is non-critical, meaning there is no variation in force as the gap varies over the stroke of the device, or if the shaft is turned in the forcer. The ability of the shaft to spin freely in the bore of the coil, while maintaining the high precision feedback from the encoder makes it a wise choice for Z Theta stages.

The absence of residual static force and the excellent relationship between the linear force and current make these motors ideal for use in micro-positioning applications. Position control of the Scaleless SL Motor is made possible by the built-in linear encoder.

An integrated solution, the Scaleless SL Motor makes integration of a linear motor a very simple matter in a wide variety of applications in markets such as medical devices, laboratory equipment, instrumentation, factory automation and robotics, to name only a few.



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As with all of its products, Gefran's Drives, Motors, and Feedback Devices are manufactured to stringent International Standards utilizing best practices and recognized quality procedures meeting International Safety Standards and Approvals. Additionally, Gefran integrates Industry standard communication protocols/fieldbuses for simple integration into robust Industrial control systems and architectures such as CANopen, EtherNet/IP, ProfiNET/ProfiBUS, EtherCAT, LONworks, DeviceNET, and ModBUS.

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tems for Synchronous and Asynchronous Motors with Encoder/Resolver feedback, and Brushless Servo Motors for Torque, Speed, and Position Control. With application based expertise in Electric Line Shaft, Web System Control, Wind and Unwind Control, and Cut on the Fly Control utilizing high bandwidth communication links and powerful Digital Signal Processing, and robust Power Control. Gefran has the products and expertise to support Customers most demanding

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Gefran's Brushless Servo Motors cover requirements from 0.2 to 442NM and 1500 to 8000RPM in IP54, IP65 and IP67 configurations.

As the world leader in DC Armature Converters, Gefran draws on its significant experience in DC Motor Speed Control from 20 to 4800A up to 810VDC. With standard solutions for 2 Quadrant and 4 Quadrant applications, we also offer application-based solutions for 12 pulse control in both parallel and series configurations. Gefran's robust DC Drives offer reliable performance and are available with Overload Capacity ratings up to 200%.

Gefran's Field Control series of Digital Field Regulators offer technical and cost effective solutions for high power motors where standard control units integrated in armature converters do not have the necessary field control capabilities, and non Motor/DC loads for Galvanic and Magnetic load applications.

Additionally the Regulation Control version of the Gefran DC Drive for Universal External Power Bridge Control is designed for loads up to 20,000A with Overload Capacities up to 200%.

With extensive Pre and Post Sales support, and Product and Application training, Gefran provides solutions to simplify the needs of Industrial Customers worldwide.

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HARMONIC DRIVE™ PRECISION GEARHEADS AND ACTUATORS provide exceptional positioning accuracy and repeatability within a few arc-seconds. Harmonic Drive gearing offers a wide range of reduction ratios in a single stage. This reduces the size and weight of both the gear and motor. Harmonic Drive gears provide zero backlash and have a long, maintenance-free life. [See a video explaining the technology.](#)



SHA-20 is the smallest actuator in the SHA family. Measuring just 94 mm in diameter and 108 mm in length, the actuator delivers up to 120 Nm of peak torque. It features a 17 mm hollow shaft and a robust cross roller bearing capable of supporting a moment load of 187 Nm. The actuator is driven with a brushless servomotor and has a 16-bit multi-turn encoder. An optional failsafe brake is available. Compatible servo drives are available with several control protocols, including EtherCAT.

Design Features

- **Through-Hole Design** – Many Harmonic Drive gearheads and actuators feature a large hollow shaft allowing cables, pipes, or shafts to pass through the axis of rotation. This can greatly simplify a design and improve reliability.
- **Flanged Output** – Many Harmonic Drive gear and actuator products feature a flanged output for direct mounting of the load. A large bolt circle diameter ensures secure mounting without the need for an additional support bearing.
- **Cross Roller Output Bearings** are commonly used in our gearheads and provide high axial, radial, and moment load capacities.
- **No Change in Size or Weight with Gear Ratio** – Harmonic Drive gears have the same size, weight, and form factor regardless of gear ratio. Reduction ratios of 30:1 through 160:1 are available.

New Lightweight / High-Torque Products

Introducing new Harmonic Drive gear units featuring lightweight materials and an optimized design.

CSG-LW and CSF-LW gearheads are 30% lighter than previous designs without reducing the torque rating or significantly changing interface dimensions. They incorporate a Harmonic Drive component set in a lightweight housing with a high capacity cross roller bearing and output flange to support the load.

SHG-LW and SHF-LW hollow shaft gearheads are 20% lighter than standard SHF units. In addition to the hollow shaft feature, the gearhead incorporates a high capacity cross roller bearing and an output flange to mount the load directly without the need for an additional support bearing.

SHD-LW is a compact, lightweight, hollow shaft precision gear unit. The gearhead incorporates a Harmonic Drive component set in an aluminum housing. It is 15% shorter and 30% to 40% lighter than the SHF series. It features a high-capacity cross roller bearing and flanged output for direct mounting of the load. The large hollow shaft allows cables or shafts to pass directly through the axis of rotation.

Gears and Actuators in Action

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.

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

Harmonic Drive is a trademark of Harmonic Drive LLC.



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Compact, High Torque, Zero-backlash Actuators



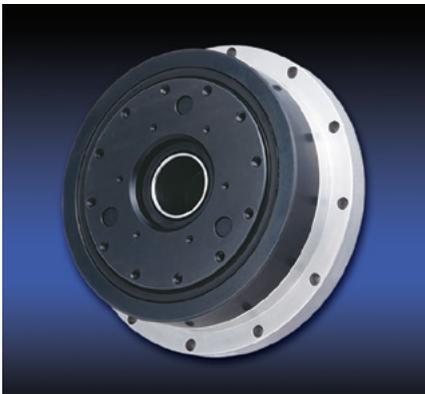
Hollow Shaft Brushless Actuators

FHA mini actuators feature a through-bore up to 14 mm in diameter and provide high torque and exceptional positioning accuracy. This is achieved in a compact design using a high performance Harmonic Drive™ gear coupled to a brushless motor and a high resolution encoder. Max. torque up to 250 in-lb and accuracy better than 1.5 arc-minute can be achieved. Available in 3 frame sizes, ranging from 50 to 75 mm square, and 48 to 66 mm in length.



RSF Mini Brushless Servo Actuators

The RSF mini series of high torque brushless servo actuators is designed for exceptional price performance. The actuators range from 30mm to 50mm in diameter and deliver torques 50% higher than comparable brushed actuators (up to 240 in-lb) at 20% faster speeds. A new 30:1 ratio is now available for maximum speeds up to 200 rpm. Positioning accuracy better than 90 arc-sec is achieved and an integral encoder can provide a resolution up to 400,000 ppr at the actuator output. These actuators are designed to be compatible with brushless servo drives from most manufacturers and are well suited for high volume OEM applications.

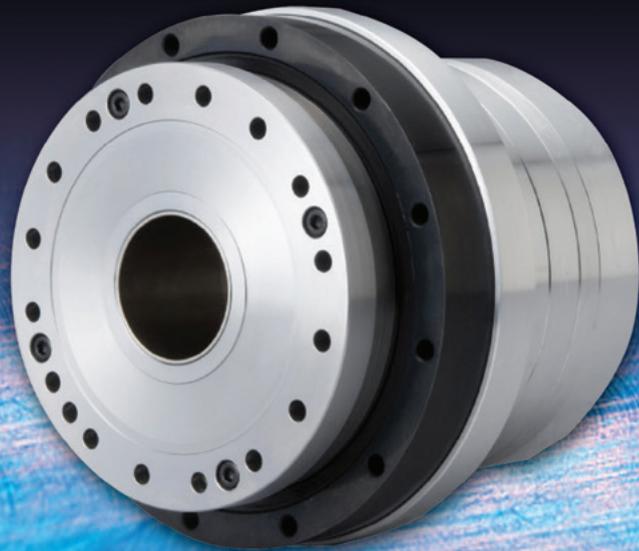


HFP Hollow Shaft Planetary Gear

The HPF Series hollow shaft planetary speed reducer allows cables or concentric shafts to pass directly through the axis of rotation. This unique precision reducer is available in two frame sizes with momentary torque ratings of 170 Nm and 450 Nm and hollow shaft diameters of 25mm and 30mm respectively. The flanged output is supported by a large cross roller bearing capable of supporting moment loads up to 932 Nm. Gears feature low backlash (less than 3 arc-minutes) and high accuracy (accuracy < 4 arc-min, repeatability ± 0.25 arc-min).

Power & Precision SHA Hollow Shaft Actuator

- High Torque Density
- 1 arc-min Accuracy
- ± 5 arc-sec Repeatability
- High Capacity Output Bearing
- Brushless Servo Motor
- Harmonic Drive™ Gearing
- Integrated Brake
- 17 Bit Absolute Encoder



The new SHA series of Hollow Shaft Actuators has the highest torque density of any actuator in its class, yet provides excellent positioning accuracy. Several sizes are available with output torques up to 30,000 in-lb. These actuators are ideally suited for robotics, automation, machine tool, and antenna positioning applications where performance and reliability are essential.



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MARKET ANALYSIS

The motion control market hit same bumps in the road over the last year, but there is reason to be optimistic, according to the Motion Control Association and ARC Advisory Group. Take a look at highlights from studies released recently by the groups.

Staggering declines in Asia drive motion control market into downturn: study

The market decline for General Motion Control (GMC) systems was affected by the sharp decline in capital equipment purchases during the second half of 2012, according to a new report from ARC Advisory Group.

The study found the rate of global growth slowed down, putting a damper on economic activity in the latter half of 2012. The sovereign-debt situation in Europe compounded with anticipation of another financial crisis slowed down investments in capital equipment.

The global economy grew by 3.8 per cent, which was not as strong as predicted. In Asia, the economic situation was not as robust as prior years. The motion control market in China sustained a decline along with Japan. Japan's economy continued to experience aftershocks of the natural disaster. The markets in North America and Latin America were the only regions to achieve a modest positive growth.

In 2012, the general relative market leadership positions experienced considerable compression in market share separation. Notably, the largest declines in revenues were experienced by several of the leading Japanese suppliers with revenue declines on the average of 12 to 20 per cent. The supply chain issues faced during the period after the tsunami resulted in indigenous Chinese suppliers capturing market share. The second-tier suppliers are being reshaped by acquisitions, according to the study.

The market witnessed an increased number of acquisitions to allow motion control suppliers to place a stake in regions where they have little presence. In prior years, the general trend in acquisitions was to extend product lines in an effort to support more comprehensive solutions. Now the market is witnessing very specific niche plays that



are strategic in nature. Conversely, larger diversified businesses are acquiring niche motion control suppliers, viewing these simply as good investments providing a predictable, but steady ROI.

"These dynamics on the supply side are creating a new competitive climate in the foreseeable future as motion control suppliers realign portfolios and centres of competency to capture growth in emerging markets and applications," said research director Sal Spada, the principal author of ARC's "General Motion Control Global Market Research Study".

China has become an important market for the Japanese suppliers; however, they have been burdened with a high-valued Yen that prices many of the Japanese products outside of their domestic market. China is also one of the largest global producers and consumers of machinery that makes this a very important market for Japan. However, indigenous suppliers in China are also growing rapidly as they are now becoming part of the fabric of the overall motion control market. Japan's motion control suppliers confronting the high-valued Yen are establishing manufacturing operations outside of their domestic market to regain control of their manufacturing costs.

Manufacturers are seeking to reconfigure the production lines automatically and more rapidly. This is driving the demand for low-cost auxiliary axes on each machine. Low-cost axes in conjunction with high-performance servo solutions are driving up the axis count per machine. This is enabling the market to withstand declines in the price points in motion control platforms.

Global motion control shipments contract in first half of 2013

Global shipments for motion control products fell by 6.8 per cent in the first half of 2013, according to new statistics released by the Motion Control Association (MCA), the industry's trade group.

"Despite the slower first half of 2013, we see optimism from motion control companies about the rest of the year," said Jeff Burnstein, president of MCA. "Our second quarter survey of MCA member companies revealed that only two per cent of respondents believe motion control shipments will contract further over the next two quarters. Optimism is higher yet among MCA distributor members, of whom 80 per cent believe motion control shipments will increase in the next six months."

"While shipments declined in some of the largest product categories, such as motors, there are a few categories that are doing very well this year," said Alex Shikany, MCA director of market analysis. "For instance, shipments of motion controllers are up 15 per cent and support services are up nearly six per cent through June."

MCA summarizes market results from suppliers and distributors in quarterly tracking reports and trend analysis reports. These reports examine orders and shipments by major product category quarterly and annually with tables and colour graphics. Growth rates and book-to-bill ratios are provided for each product category. MCA also provides an economic indicator report, which enables report users to interpret quarterly statistics from the standpoint of macro-economic indicators by individual manufacturing industry, as identified by the North American Industry Classification System (NAICS).

CASE IN POINT

How new motion control technology is helping manufacturers



Space constraints are no issue for new drive technology

SAF Drives, Inc., based in Kitchener, Ont., had a problem. The space constraints of a naval ship for one of their customers required a smaller footprint contactor than what SAF was currently using. Can new technology eliminate this problem?

After viewing a demo trailer, SAF Drives, Inc. learned that the Eaton XT IEC contactor could be incorporated directly into a soft starter for a 1000HP 480V bow thruster. This compacted contactor would allow SAF to meet the space constraints on a 673-foot-long naval ship and eliminate additional installation costs.

SAF, one of North America's leading manufacturers of drive solutions and solid-state start-

ers, had been using a competitor's products, but it had become dissatisfied with the manufacturer's ability to provide products, technical assistance and inability to mount its product within a soft starter. Since the IEC contactor is a small footprint product with a high current rating, it met the application requirements.

SAF president Kedric Foster said, "We were able to incorporate the Eaton contactor, which is 30 per cent smaller than any competitive offering, directly into the soft starter for increased space and cost savings. This was particularly important for this installation because we needed to build a split cabinet design as the cabinets are actually disassembled into two sections on-site, allowing them to fit below the deck on the ship. Without this capability, major plumbing and

construction costs would have been added to the project for retrofitting the ship with a larger entrance door for below deck access."

Using the contactor for the application led to an estimated savings of \$2,000 per installation for the soft starter alone. If SAF had used a different offering, it would have had to mount the contactor on the bottom of the breaker cabinet, which would have required additional bus work.

"On normal applications, we see a space savings of typically one cabinet size on enclosed soft starters with bypass," Foster said. "For example, a 400HP 600V soft starter in a NEMA 12 cabinet with bypass would typically be installed in a 48 x 36 x 16-inch cabinet. With the integrated design, we are able to construct in a 36 x 30 x 16-inch cabinet."

Energy-efficient bearings prove their worth at textile plant

Along with the rest of Indonesian industry, Leuwijaya Utama textile company (Leuwitex) was confronted with a government-enforced increase in electricity costs. For a company with 300 textile weaving machines and 176 twisting machines consuming 2,120 megawatt-hours (MWh) per month in their Bandung factory, this represented a major increase in operating costs, and one that needed a speedy reaction in order to reduce the effect on the threat to bottom line profitability.

Immediately after the increases were announced, the management of the Leuwitex Bandung factory searched for ways to reduce energy consumption throughout the entire factory. As well as ensuring unnecessary lighting and standby machinery were switched off, they took a detailed look at the production. The factory, one of three in Indonesia, produces some of the most sought-after fabrics in Indonesia, and exports to the Middle East, Malaysia and Europe.

Focus on twisting machines

To produce the daily volume of almost two

tons of fabric, the Bandung factory has the usual range of textile machinery, including electric motors, weaving machines, spinning machines and twisting machines. First investigations showed that 30 per cent of the factory's energy consumption was consumed by the twisting machines, an important piece of machinery that is critical to fabric quality. In addition to taking measures to correct electric motor energy losses and optimizing frequency converters for the overall electricity supply, the team at the plant discussed the energy consumption of the twisting machinery.

Mechanically, these machines are fairly straightforward: a series of lines of high precision spindles driven by two powerful motors. Frictional losses and energy losses occur in the rotational motion as these machines operate 24 hours per day, by virtue of the quality of the bearings fitted at each end of each spindle. With 176 twisting machines, each with 256 spindles, this was clearly an opportunity for energy savings.

Evaluating the options

Leuwitex's plant manager decided to select three of the most likely ways to optimize bearing cost and frictional losses, and put them to

test in his spindles. The three potential solutions were: new bearings from the supplier of those in the original spindles; low-cost bearings from a local Chinese manufacturer; or SKF energy-efficient bearings, which claimed to offer up to 30 per cent friction savings.

He fitted the bearings to three separate spindle lines and ran them for three months, monitoring specifically the energy consumption of those three lines. The result was an overwhelming victory for the energy-efficient bearing, with around 10 per cent total energy savings. Extrapolating this result to the expected lifetime of the spindles would conclusively save the most energy and deliver the lowest total cost of operation.

Extending tests to a production run

The next test was to fit the energy-efficient bearings to 10 twisting machines and begin a production run. The initial test was extended by adding more lines of spindles while keeping the original 10 operating. Regular product quality checks among all the machines convinced the plant manager that he had indeed found his answer to the best bearings for his textile machinery from both an energy efficiency and bearing performance point of view.

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