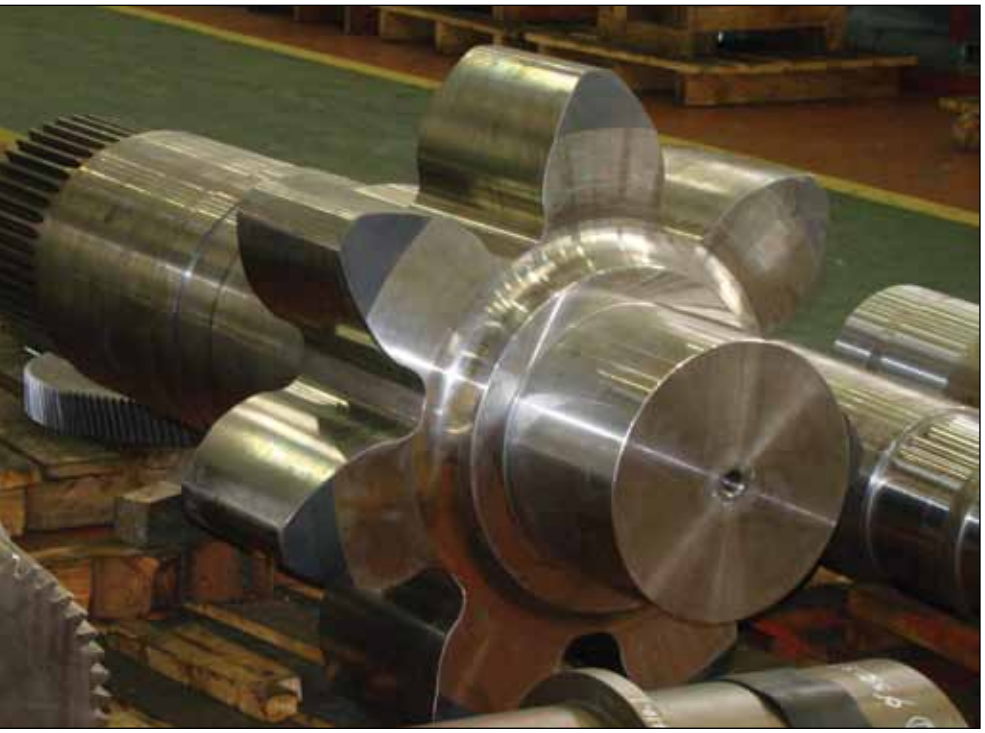
SKF Bearings Assist Gearbox on the High Seas



The final drive/output pinion for the jacking gearbox provides the power needed to operate the platforms in harsh conditions (courtesy of SKF).

Jack-up platforms are designed to float to a location and then have the drilling platform "jacked up" off the surface of the sea for oil drilling operations. One piece of critical equipment is the jacking gearbox that provides the power to lower the platform legs onto the sea floor and then lift the enormous weight of the drilling platform high enough above the water so there is no interference to drilling operations from wave motion, even in stormy conditions.

SKF CARB bearing

The Hyosung Corporation of Korea claims that their jacking gearboxes give the kind of reliability and power needed for working in such an environment. SKF has contributed 23 bearings in each of the latest designs of the gearbox, including the SKF CARB toroidal roller bearing, a bearing that delivers high carrying power in the smallest package of any bearing type.

Won-Cheol Hong, senior designer at Hyosung Industrial Machinery, began this project to design a smaller, lighter, more powerful jack-up gearbox for oil drilling platforms. The bearings that support the shafts and gears as they lift the enormous weight of the platform at 1.5 feet per minute are a major component in the gearbox design. The weight of the platform and the demanding operating conditions mean that minor deflections of the shafts cannot be avoided.

To prevent premature bearing failure in gearbox applications, the bearings must be able to accommodate these deflections in all conditions throughout the life of the gearbox. Hong's final selection included SKF tapered roller bearings, spherical roller bearings and CARB bearings for the very demanding load carrying in the planetary gears. This selection resulted from thorough advanced modeling of the gearbox together with sophisticated bearing life and load calculations, carried out by SKF.

Today, more than 500 sets have been delivered for offshore drilling applications and will be incorporated in new platforms being commissioned in the next few years. The first drilling platform equipped with these gearboxes started drilling off the coast of China in January 2009 and will stay there for three years. The oil rig, operated by a U.S. company, utilizes 54 Hyosung reducers to jack up the drilling platform with 18 gearboxes on each of its three support legs.

With the oil drilling platform expected to be active for 20 years, the operators want efficient and trouble-free operation during the anticipated 2,000 total hours of lifting and lowering of the platform once it is positioned, after the vessel is moved to various drilling sites. The first gearboxes produced have a lifting capacity of 440 kips (kilo-pounds) and a holding capacity of 700 kips in normal conditions, extending to 1,000 kips in severe storming conditions. Later models had a 550 kips carrying capacity with proportionally more holding and severe storming capacities.

"I am very happy with the technical

SKF CARB bearings allowed the Hyosung Corporation to downsize the gearbox for high sea operations (courtesy of SKF).

support I received from SKF in this project," says Hong. "I was visited by European SKF engineers who had applied CARB bearings in other heavy industry applications such as steel mills, pulp and paper plants and wind turbines. They gave deep technical presentations to me and my staff that gave us the confidence to go further in the development. The use of CARB, and its self aligning ability, allowed us to design low profile gears that are wider, stronger and give greater torque capacity than previous designs. This allowed us to downsize the gearbox. CARB's ability to take up minor misalignments and heavy loads improves the gear meshing and improves the gearbox efficiency."

SKF's CARB bearings are self-aligning radial bearings with an inner ring that moves independently of the outer ring, enabling the shaft to move smoothly without inducing axial loads. It accommodates misalignment like a spherical roller bearing and axial displacement like a cylindrical roller bearing. Additionally, it carries extremely high loads due to relatively long and barrel shaped rollers. Because the rollers are barrel shaped, and the inner and outer rings are correspondingly concave and symmetrical, the bearings will always position themselves in the raceway for optimum load carrying performance.

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Pump Application Endplay Vibration Eliminated

A beveled retaining ring from Rotor Clip Co., Inc. is used to stop endplay vibration in a pump application.

The bearing of an automobile power steering pump was being retained by a threaded nut to eliminate vibration caused by endplay. Extra labor was needed to machine complementary threads on the housing in order for the nut to be installed. The nut also required a specific torque during installation for each unit, which increased labor and costs.

In order to resolve this problem, Rotor Clip Company, which manufactures retaining rings, hose clamps and other similar products, machined a simple groove into the application to allow the complementary angle of the beveled ring to assume the function of the more expensive and cumbersome nut. Once installed, the retaining ring eliminates the need for additional labor to torque the part or machine threads on the housing. Also, the cost of the beveled ring used is less than the original nut.

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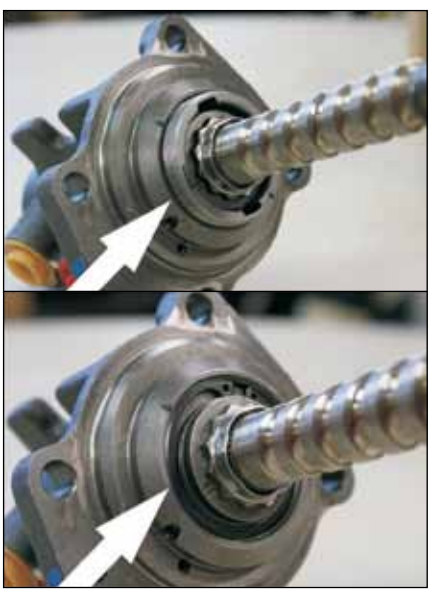
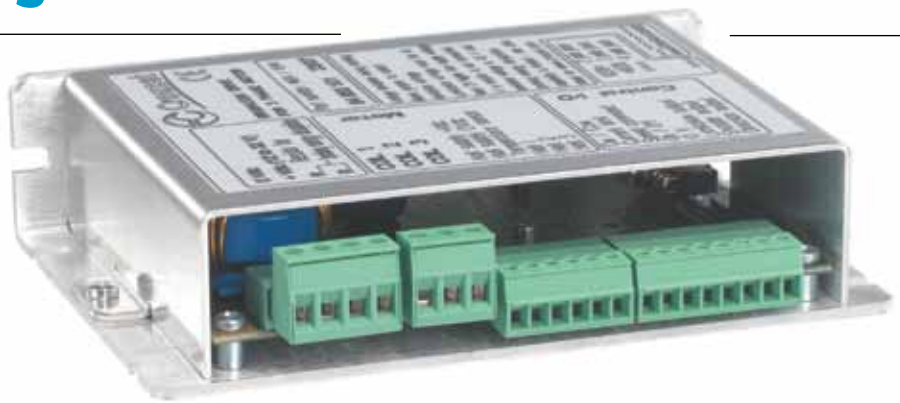


Top: The original application with the threaded nut installed. Bottom: The threaded nut has been replaced by a beveled retaining ring from Rotor Clip Co., Inc.

Crouzet

EXPANDS BLDC POWER RANGE



The BDE40 Controller can be used with most three-phase brushless Hall effect motors in a range of motion control applications.

A line of high-performance, geared BLDC motors is available with a complete tool kit of selectable gearboxes, controllers, brakes and smart drives from Crouzet North America, a company of Custom Sensors and Technologies. The motor's concept allows different configurations to be assembled quickly for fast prototyping while providing a complete automated solution tailored for individual customer needs.

The motor line provides more options for Crouzet's motor offerings. "Crouzet has expanded the continuous power range of the BLDC motors it offers from 30–100 watts to 17–205 watts," says Jim McNamara, Crouzet application engineer. "The gearboxes used in this product are designed for a longer service life than other Crouzet models."

The low-cost BLDC motors feature a wide selection range for power, speed, torque and size. The motors include continuous power up to 400 watts, speeds between 1,500 and 6,100 rpm and motor constants up to 15 ounces per square root watt (103 mNm per square root watt). Maximum torque constants feature up to 198 ounce-inches/amp (1,400 mNm/amp). The six new models include two round and four square designs with lengths ranging from 41 millimeters to 114 millimeters. Motors can be ordered with a factory-mounted optical or magnetic encoder and can be fitted with electromechanical fail safe power-off brakes.

"The power range of 17 to 205 watts is best for small, but not micro applications," McNamara says.

Compatible gearboxes feature spur, planetary and worm styles with torques from 0.4 Nm to 120 Nm. The BDE30 and BDE40 external drives are offered in 6A or 14A max respectively. Internal drives are available on BLDC motors that feature power ranges from 40 to 100 watts. "Accessories include right angle and planetary gearboxes, brakes and encoders, and external drives," McNamara says.

The motor control solution is appropriate for a range of applications in the medical and industrial markets. Uses include automation for endoscopy, x-ray and dental equipment, robotic pool equipment, peristaltic pumps, access control, printing and bill boards. "One customer uses our 80 watt BLDC motor with an integrated controller in a solar powered pump application," McNamara says. "Another customer uses a BLDC motor with a controller for automatic subway doors that provides high acceleration and dynamic braking."

The motor line was in development by Crouzet for about two years. "Crouzet's goal in developing this new product was to satisfy premium application performance requirements beyond Crouzet's previous offerings," McNamara says. "This product line offers increased performance with expanded power range and service life over other Crouzet products."

Crouzet typically adapts products for specific customer requests. "Our new 'tool kit' approach of interchangeable motors, gearboxes, controllers, brakes and smart drives allows us to provide fast, automated solutions at an excellent value."

Crouzet also recently released the BDE40 Controller as a complement to its line of standard and custom Brushless DC motors. The BDE40 can be used with most three-phase brushless Hall effect motors in a range of motion control applications, and it includes four-quadrant functionality and load resistor protection.

The device features a four-quadrant design for applications that require standard forward and reverse motor control as well as closed-loop speed control for motor slowing and stopping.

Crouzet's low-cost BLDC motors feature a range of power, speed, torque and size selections.

Typical applications include control for production conveyor belts, production robot trolley wheels, medical, food mixing machines, cutting and packaging machines and other applications with 12 or 24 volt power supplies that need powerful motors.

The BDE40 delivers up to 360 watts with 11 to 36 VDC, 10 amps nominal and a maximum continuous current of 14 amps. Resistors protect against over-current, polarity inversion and short circuiting. Other performance features include an absorbed current of 0.1 amps, temperature rise of 50 degrees Celsius, ambient operating temperature of 20–40 degrees Celsius and storage temperature of 40–90 degrees Celsius.

The BDE40 can be used as a stand-alone controller, connected to a PLC or driven by potentiometers. The unit comes standard with guide, braking resistor, protection diodes and connectors.

"The new controller was introduced to provide a convenient new solution for our customers," McNamara says. "Brushless DC motors always require a driver, and by offering a universal-type controller solution, our customers don't need to go elsewhere to complete the package."

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Automotive Control

REDUCES TIME TO MARKET

Sauer-Danfoss' Automotive Control (AC) solution offers OEMs a complete Safety Integrity Level Two (SIL 2)—according to IEC 61508—certified

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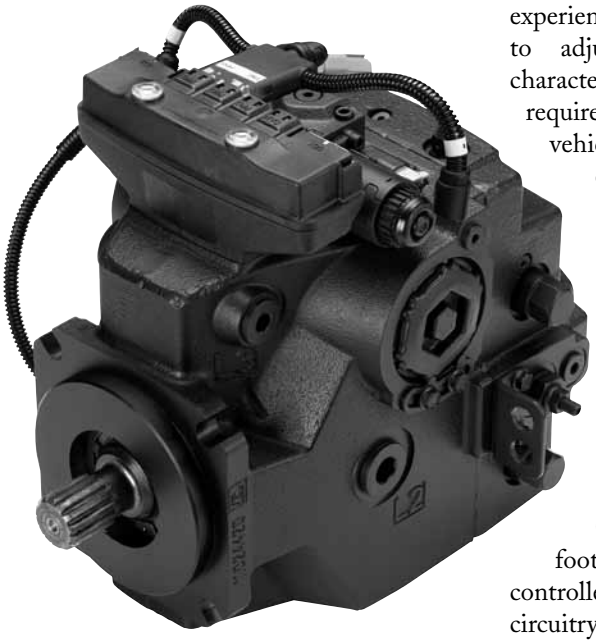


transmission system that significantly reduces OEM vehicle development, qualification expenses and new product time to market.

The Plus+1 compliant system features an H1 variable piston pump with embedded electronic control, H1 bent axis variable piston motor, sensors and associated human machine interface (HMI). The AC combines with software to provide an automotive style automatic transmission driving experience that allows operators to adjust hydrostatic transmission characteristics to suit specific operating requirements. It helps increase vehicle performance and overall efficiency with improvements in productivity and comfort.

The H1 embedded controller (H1 AC) features electronics mounted directly to the pump. The electrical connections are designed to provide simple OEM vehicle installation and complete semi-automatic sensor calibration for Plus+1 Compliant drive and inching foot pedals, as examples. The controller also has added "watch dog" circuitry, which provides real-time fault monitoring of the electronic hardware. Optional software monitors redundant HMI input channels while H1AC provides single fault tolerance for AC vehicle transmission systems. This is useful for vehicle manufacturers trying to meet European Machinery Directive 2006/42/EC and related safety standards (ISO 13849-1:2006), and it also reduces OEM cost and time needed for system qualification and vehicle certification.

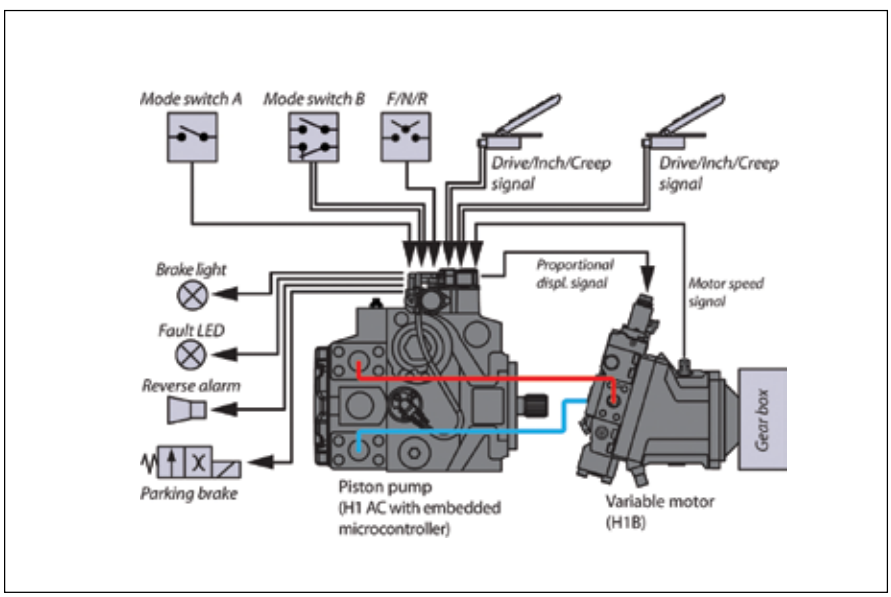
"Our H1 Automotive Control is the first solution on the market to offer the precision and consistent performance of intelligent electronics, combined with complete drive system functionality, system qualification and SIL 2 certification," says Joseph P. Maher, system portfolio manager. "OEMs will be able to reduce time to market for new vehicles and model variants while still customizing vehicle behavior and providing differentiation for their products."

The H1AC software is also designed to SIL 2 IEC 61508 standard. Other features include engine anti-stall and protection against engine over-speed, extreme high and low hydraulic oil temperature conditions and hydraulic motor over-speed. Variations in hydraulic oil viscosity affecting control performance are compensated for automatically, so the vehicle's operating temperature performs predictably.

The system is customizable via the Plus+1 Service Tool between four operator system modes that are programmed according to three main propel methods or mode types: automotive, non-automotive and creep-automotive mode. Other features include the ability to further customize hydraulic pump and motor displacement control profile and ramp times, provide constant speed drive functionality, interface to vehicle systems via CAN simple diagnostics.

The OEM can configure up to four different system modes with varying vehicle drive behaviors to meet various application requirements by using the Plus+1 Service Tool AC software service screens. The system modes are chosen through vehicle switch settings, so OEMS can create working and driving modes, design driving behavior to suit specific working conditions or operator skill level. This makes the same hardware appropriate for a range of vehicles with different software settings.

For more information:
www.sauer-danfoss.com/acsolutions



Torque Sensor

FAST TRACKS UAV FOR TAKEOFF

Development of a vertical take-off and landing unmanned aerial vehicle (UAV) is near completion with the help of a non-contact digital torque sensor, TorqSense, which proved the most viable option for use on the test rig. The search and surveillance UAV is intended for military, homeland security, policing and environmental monitoring. It is rugged, immediately deployable and can be launched from the ground, ship or even moving vehicles. The vectored-thrust UAV platform is used for any situation requiring safe aerial viewing or sensor measurement. It is being developed by Selex Sensors and Airborne Systems (S&AS), a Finmeccanica company.

"The TorqSense technology has been one of the key enablers for the development and implementation of the novel propulsion system on the Damselfy UAV," says Mark Agnew, Selex's chief engineer for UAV systems.

The project is led by Selex's Ashley Bryant, who at first wanted to build a flyable scale model replica of the vertical take off Harrier jump jet, but there was apparent opportunity for a professional UAV. Bryant ruled out using a jet engine, deciding a cold fan solution was the only reasonable option.

"A jet engine combusts fuel to turn its turbine and create thrust," Bryant says. "Our cold fan is driven, via a drive shaft, by a minuscule but powerful two-stroke engine. Developing this technology required us to build a unique test rig, with an in-line torque sensor, so that there were no out of balance forces coming into play."

The TorqSense system from Sensor Technology met all his needs. Other requirements included ease of mounting, so the drive system could come on and off the rig often, and a need to interface with a PC so that real-time performance data could be logged and analyzed.

TorqSense's digital measurement system has two tiny ceramic piezoelectric quartz combs that resonate at fixed frequencies and are fixed to the system's shaft. While the shaft rotates and torque is applied, the combs distort and the resonant frequencies change proportionally to the applied torque. Frequency changes are monitored digitally by the TorqSense electronics in a non-contact manner using an RF couple, and a several outputs are available.

"Our development program was speeded up because of the ease with which we could lift the drive on and off the test rig, and the fact that we could automate the data capture and anlaysis," Bryant says. "If it weren't for TorqSense, we could not have kept to our development schedule and would have suffered consequential budget stresses too.

Bryant is considering adapting the TorqSense as a permanent feature of the UAV. "We would use the quartz combs in the usual way, but would integrate the electronic functions with the existing on-board controllers, so the weight gain would be tiny. We would then be able to monitor the drive conditions in flight through our existing remote control system, improving reliability and controllability."

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Kollmorgen Drive

DELIVERS SCALABLE PROGRAMMABILITY

The Advanced Kollmorgen Drive (AKD) is Ethernet-based and delivers high performance with flexibility, scalability and power range for most application requirements, including basic torque and velocity applications, indexing, multi-axis programmable motion via the company's complete machine automation solution: Kollmorgen Automation Suite.

AKD allows machine builders to standardize on a single drive family with a common graphical user interface across the power range for high machine performance, throughput and accuracy across applications, all while minimizing engineering time and costs associated with stocking, understanding and programming multiple types of drives.

"AKD is specifically designed with the versatility, communications and power that OEMs need to expand machine performance and increase integration speeds," says Josh Inman, product manager for Kollmorgen North America. "The AKD facilitates true plug-and-play operation with standard Kollmorgen servomotors and linear positioners to get an optimized, high performance system up and running quickly, in less space and time and for less cost than lower performing options. Multiple Ethernet connectivity options available from the base hardware support a variety of open and closed protocols, without the need for separate option cards. And a broad power range in a smaller, compact design enables machine builders to use these robust drives with a single interface."

The AKD is available for 120/240 VAC or 480 VAC operation with a power range of 3 to 24 Arms continuous current, 9 to 48 Arms peak. Coming later in 2010 is a power range up to 96 Arms continuous and 192 Arms peak.

The AKD is capable of supporting various feedback devices and Ethernet Motion buses from the base hardware without separate option cards, including Smart Feedback Devices, Endat, BiSS, Analog Sine/Cos encoders, incremental encoders, HIPERFACE and resolvers. Supported Ethernet Motion buses include EtherCAT CANopen and Modbus/TCP.

Patented Autotuning algorithms automatically adjust all gains, including patent-pending observers. This functionality also brings immediate, adaptive responses to dynamic loads with precise control. Autotuning can also help overcome imperfect mechanical designs to help machine builders solve difficult scenarios by compensating for compliant transmissions and couplings that typically take away from a machine's intended performance.

The GUI features a six-channel real-time software oscilloscope for quick commissioning and diagnosis. A multi-function Bode plot helps users evaluate performance while Auto-complete functionality of programmable commands saves looking up parameter names. Machine performance data is sent immediately by one-click capture and sharing of program plots and parameter settings.

According to Inman, "Because AKD makes it so easy to monitor system performance and share system information, there is virtually no effort required to get a Kollmorgen motor and drive system up and running—and the user friendly interface across the power range makes commissioning and general interactions a truly intuitive process."

For more information:

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Crown Gear Drives

DESIGNED FOR FULL RANGE OF APPLICATIONS

Zero-Max Crown Gear drives provide directional motion change in all types of power transmission systems. They are right-angle gear drives that operate quietly, are compact and sealed from contaminants. High class 10 spiral bevel gears and non-magnetic stainless steel shafts are features.

The Crown Gear drives were designed to cover the full spectrum of machine applications from packaging systems to food processing and material

handling systems. They are suitable for a wide range of horsepower, torque and shaft speed requirements. Zero-Max offers the drives in standard two- and three-way models with 1:1 and 2:1 speed ratios, shaft diameter combinations of 3/8, 1/2 and 5/8 and 3/4 inch.

The hardened class 10 spiral bevel gears are permanently mounted to the shafts with locking pins. The result is a durable connection for use in heavy load applications without maintenance.

Long-life, precision hardened and ground ball bearings provide quiet operation at speeds up to 2,000 rpm in most environments. The drives are pre-lubricated and completely enclosed in heavy-duty cast aluminum housings. The design ensures that internal gears remain permanently aligned, lubricated and free from outside debris contaminants.

Optional features include different shaft configurations, housing modifications for special mounting requirements and special finishes that include squared, splined, extended, shortened, stepped and combinations. Housing modifications include machining of special mounting flanges and mounting holes.

"Crown drives have been increasingly popular for use in automation systems because of their high quality, robust design and minimal backlash operation," says Robert Mainz, Zero-Max sales manager. "They easily handle reciprocating motion in most automated packaging machinery, paper converting, food processing and similar applications."

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Digital Servo Drives

FEATURE PCB MOUNT DESIGN

Servo2Go.com has added PCB mounts to its broad range of digital servo drives from Advanced Motion Controls. The DZ drives are micron-sized servo drives require less space than a standard business card and weigh about the same as two golf balls. Designed to be completely compact, DZs take up little space and eliminate wiring hassle.

Providing 10–80 VDC operation while delivering 12 amps continuous/20 amps peak current, DZ Series can be configured to operate in torque, velocity and position modes for brushed, voice coil or brushless motors. Units deliver up to 1 kW continuous power when needed and can achieve up to 98 percent efficiency. Supporting CANopen and RS-232/485 up to ~1 Mbaud, drives accept a variety of input commands including PVT, ±10 V analog, encoder following, step and direction, and PWM and direction.

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product news

Linear Rail System

OFFERED IN VARIOUS CONFIGURATIONS

Haydon Kerk Motion Solutions, Inc. offers the LRS Linear Rail System in several configurations, both motorized and non-motorized. These linear rail systems consist of a stationary base and a load bearing carriage that travel along a rigid extruded aluminum rail.

The LRS Linear Rail Systems come with several in-line motor options, including a single stack or double stack size 17 stepper motor, a stepper motor with an integral chopper drive or the IDEA programmable linear actuator, which consists of the stepper motor, drive and controller programmed through a graphic user interface. The LRS is also available without a motor, so designers can integrate with a variety of motor types and belt and pulley configurations.

The carriage design controls slide bearing play with a patent-pending, self-adjusting linear bearing. "T" Slots that provide the capability to mount limit switches and sensors are integrated along the length of the rail system. The lead screw is made from 303 stainless steel and can be configured with optional Black Ice TFE coating for permanent lubrication. The LRS Linear Rail system comes standard with a general purpose lead screw nut, but in cases of extreme control, the system can be configured with a Kerk CMP or WDG precision anti-backlash nut.

For more information:
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Extreme Encoder

WITHSTANDS THE ELEMENTS

The Extreme 1000 series from Leine & Linde offers encoders for severe work environments. Available in North America through Heidenhain Corporation, the measurement and function range on this encoder is especially designed to meet the requirements of the steel, crane and mining machinery industries. The encoders stand up to extreme mechanical stress, vibrations and shock, as well as dusty environments with high temperatures.

The sturdy bearings and enclosure allow the 1000 series to achieve high durability across applications. The enclosure is rated IP67 and protects the encoder's internal components from dust and liquids. A stainless steel housing is available as a special option.

Different incremental and absolute versions are available, and a combination of the various encoder types can be integrated in the same 1000 series product. Absolute pulse encoders with *PROFIBUS* interface are now capable of enduring tough industrial environments for the first time using the 1000 series encoder.

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