Media Kit

solutions for the
Smart Designer

high-speed proportional servo-pneumatic systems

ENFIELD TECHNOLOGIES

ENFIELD TECHNOLOGIES

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www.enfieldtech.com

ENFIELD TECHNOLOGIES

Backgrounder

Established: 1990

Corporate Status: Connecticut-based, privately held, limited liability corporation

History: The initial servo-pneumatic control system was developed in 1990 and Enfield Control Valve (ECV), Inc was formed. The system was manufactured and marketed using a series of licensing agreements. When these agreements expired R. Edwin Howe purchased ECV, Inc. in early 2003. He immediately restructured and re-financed it to better serve customers and increase the pace of research and development. New and improved products were launched in early 2004. The name was changed to Enfield Technologies to be more recognizable and better reflect its new focus.

Key Personnel: R. Edwin Howe, President
Vincent P. McCarroll, Chief Engineer

Products: Enfield Technologies manufactures advanced, high-speed, servo-pneumatic control systems that help automation designers control position, pressure, force, flow and velocity in either open- or closed-loop applications. The company's primary offering is a system comprised of a dedicated device controller and a proportional 5-ported, 3-position, closed-center directional control valve for a unique yet simple and easy-to-use package. The valve and controller are highly flexible and adaptable to the changing needs of the designer. The valve uses patented linear force motor technology to provide unparalleled linearly proportional control with almost zero hysteresis. The valves are available in 3 sizes to control a range of pneumatic automation devices including actuators up to 5 inches (125mm) in bore and pressure vessels. The company has previewed an easy plug-and-use linear actuator that combines the most common elements of a positioning system, including an air cylinder, control valve, electronics, and sensors; the system will be available in the first quarter of 2004.

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Backgrounder

Applications Served: There are hundreds of applications for our servo-pneumatic control systems and applications can be broken into the following categories.

Industrial Automation
- Processing
- Assembly
- Packaging

Product Testing
Animatronics

Industries Served: Virtually every industry now utilizes proportional pneumatic control in one form or another. Following is a sampling of industries using Enfield Technologies' servo-pneumatic control systems:

Aerospace	Glass/Ceramics
Automotive	Logistics/Material Handling
Consumer Goods	Petrochemical
Food & Beverage	Pharmaceutical
Forestry/Paper	Semiconductor
General Manufacturing	Textiles

Customer Base: A wide range of original equipment manufacturers, end users, system integrators, and research and educational institutions from the United States, Canada, Mexico, United Kingdom, Germany, Italy, France, Spain, Japan, Korea, Hong Kong and Australia are successfully using our products. They include well known companies such as Alcoa, Boeing, ExxonMobil, Helix, Hitachi, Pepsi, PPG, Procter & Gamble, and GM/Saturn among many others.

Distribution: Enfield's products are available internationally, and shipped directly to our customers. We maintain an inventory of products that enables us to provide same-day shipping.

Customers can purchase our products through one of the following methods:

- from a network value added resellers and system integrators, or
- directly from Enfield via fax or telephone, or online using our account management system and either American Express, MasterCard or VISA.

Our online account management system allows customers to place orders, review their account status and history, track shipments, and establish and maintain customer service cases.

ENFIELD TECHNOLOGIES

Biography

R. Edwin (Ed) Howe
President

Ed Howe's 15-year career – encompassing entrepreneurship, banking, and consulting – is perhaps best characterized by his extensive involvement in guiding emerging companies, as well as those seeking direction on how best to make significant business model changes.

In 1989, Howe joined Andersen Consulting (now Accenture) as a programmer and business analyst in the company's IT division, quickly followed with a promotion into the management strategy group where he focused on logistics, marketing and operations strategy.

Howe served as project manager and a key role in the developing and authoring of "The Logistics Handbook" (1994, The Free Press).

Howe in 1992 went on to co-found Opta, and developed that company's marketing introduction plan for the production of rear-projection video screens, culminating in the sale of the company to Stewart Filmscreen. In 1993, Howe launched Eto, a men's sportswear company.

In 1995, Howe sold Eto to a business partner and founded MMXX Twenty-Twenty, a strategic consulting firm. Projects included the formulation of strategy and execution plans for consumer digital cameras and digital projectors used by businesses.

Howe in 1998 joined the technology investment banking group at PaineWebber where he served as calling officer and primary transaction manager on a variety of financing and advisory transactions for technology clients, and most recently specializing in software and IT services. Howe joined UBS when it acquired Paine Weber in 2000.

By mid 2001, Howe once again was taken with the idea of owning and operating a technology-based manufacturing company. He founded investment group Chorus, LLC and began searching for a high quality specialty business to buy. In late 2002 he found a gem in ECV, Inc, a leading-edge company serving the multi-billion dollar, advanced motion control industry. Howe purchased the company in early 2003, and changed the name to Enfield Technologies to be more recognizable and better reflect its new focus.

Howe holds an MBA with honors from the University of Chicago Graduate School of Business, and a BS in business administration from Miami University (Ohio).

He also currently serves on the board of Chicago-based SGS Net, a technology and interactive marketing services company.

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ENFIELD TECHNOLOGIES

Biography

Vincent P. McCarroll
Chief Engineer

Vince McCarroll has spent his entire career in the advanced automation control industry, beginning in 1957 as a systems design engineer for the Curtiss Wright Corp. For the past 12 years, he has been the Chief Engineer of Enfield Technologies and its predecessor companies, where he was instrumental in the development of its patented, servo-pneumatic LS System.

At Curtiss Wright, he led projects to design and test analog computer systems for the first electronic flight simulators available for commercial and military air transports and fighter jets. In 1962, he joined Sikorsky Aircraft as an electronic system test engineer, designing and developing manual and automatic test equipment for helicopter autopilots. Subsequently, he served as a senior applications engineer at Measurement Systems, Inc., a maker of digital and analog machine interface devices; senior designer at Sperry products Division of Automation Industries, where he designed digital ultrasonic instruments, data acquisition systems, and multi-axis manipulators. He also worked at Unimation, the creator of industrial robots. At Unimation, McCarroll served as the development engineer in charge of industrial robotics and computer driven robotic controllers, and he implemented the first digital robot servo-drive. At Krautkramer-Branson, McCarroll served as a project engineer and manager where he developed a microprocessor-based portable ultrasonic thickness gauge.

McCarroll served as a research and development consultant to the predecessor of ECV, and in 1991 he joined Robohand in the same capacity when Robohand licensed the ECV technology. At Robohand, he advanced the design, development, and application of servo-pneumatics, including the development of software for end users, the adaptation of a balanced spool design, and the introduction of digital servo-pneumatic valve controllers. McCarroll has conducted seminars and provided advanced application support in the field of industrial automation. In 2003, McCarroll joined Enfield Technologies when it acquired ECV.

McCarroll holds several patents for his work, and is the author of numerous papers on electronic controls for complex automation systems. He holds a certificate in electronic technology from the RCA Institute; a BSEE from the Fairfield University School of Engineering; and he has completed advanced studies at the University of Connecticut.

McCarroll is an Adjunct Professor in the mechanical engineering department of Fairfield University, where he serves as a lecturer in the Mechatronics program.

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Frequently Asked Questions

Why should I use servo-pneumatics instead of electro-mechanical or proportional hydraulics control?

All three control system types have their place in the designing industrial automation, product testing and animation. However, most applications don't need the precision that electro-mechanical control systems offer nor do they need the force generated by hydraulic systems. Using a servo-pneumatic system can save a designer between a third and two-thirds the cost of an equivalent electro-mechanical and proportional hydraulic system. System cost includes device controller, linear actuator, motor or valve, and feedback sensors.

Additionally, for applications involving food or cleanrooms servo-pneumatics eliminates potential contamination caused by leaking hydraulic or lubricating oils.

Are Pneumatic systems as expensive as electric or hydraulic drives?

Electric drives cost from hundreds of dollars to several thousand dollars depending on the size of the motor, the sophistication and power of the controller, and the nature of the mechanical components. Pneumatic systems are typically far less expensive, often half the cost. Hydraulic drives are typically several times the cost of pneumatics because hydraulic pump system is far more expensive than an air compressor, and hydraulic components must be built to withstand extremely high pressures. The costs of maintaining a pneumatic system are often far less than the costs associated with both electric and hydraulic systems. The life expectancy of components in all three technologies is about the same. So, with lower capital investment costs and lower maintenance costs, the total cost of ownership of pneumatics is lower and thus the return on investment is higher.

Can a pneumatic system be controlled like an electric drive?

A pneumatic systems can be controlled to start and stop anywhere between the minimum and maximum range of the mechanical components it is controlling. The ability to do this is called proportional control. In order to achieve this, a sophisticated controller and a fast acting proportional valve are required. The controller must be capable of calculating the precise velocity trajectory profile for the commanded motion and control the valve's output to provide the exact air flow to the cylinder to execute the motion command. The overall effect of a proportional pneumatic system is similar to that of an electric drive, but the control scheme and components are different.

What about the compressibility of air?

The "spongy" effects caused by the compressibility of air have long been an issue for designers of industrial automation, product testing and animation. However, the LS System's sophisticated control system and multiple feedback design monitors the system for the effects of compressibility and immediately corrects the issue.

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Frequently Asked Questions

Aren't pneumatic systems spongy?

Pneumatic systems are perceived to be soft and unable to resist movement resulting from an external disturbance. In some cases this is true, but the perception is most often cause by systems that have been under-specified to withstand the forces created by the external disturbances. If it is known that an external force or load change is likely and the magnitude is of this change is known, then air cylinders and valves can be selected to provide the necessary restoring force to overcome the applied external force.

Are pneumatic systems precise?

Pneumatic systems do have a level of precision that is dictated by the speed of response of the controlling electronics and valve. If the electronics can detect and resolve the actual status of the commanded load with a high degree of resolution, and the valve response time is fast enough, the system will come to rest with zero velocity at precisely the commanded value with a measurable error. This error depends on the amount of stiction in the load support system, as well as the acceleration and deceleration speeds versus the dynamic load of the system. These conditions are not unique to pneumatic systems but apply to both electric and hydraulic systems. The LS System has fast and accurate electronics and valves that bring a new level of precision to pneumatic systems.

Can pneumatic systems support large loads?

Pneumatic systems consisting of a controller, valve and cylinder must be "sized" to support and move the specified load in both vertical and horizontal position applications. The orientation and support structure must be defined first. The maximum load is then determined. From this information, calculating the area of the piston and multiplying this by the available air pressure determine the cylinder or actuator bore and stroke. For example: if the cylinder bore is 2 inches diameter then the piston area is 3.14159 inches2. With 40 pounds per square inch (psi) of air pressure, this cylinder can support almost 127 pounds. Likewise, 8-inch bore cylinder under the same conditions can support over 2,000 pounds. In most industrial automation applications, these are large loads.

Can the system be used with PLCs and computers?

Yes. We recommend that high quality analog input/output modules be used with your PLC and a digital-analog converter be used with computers. There are even simple USB connected analog I/O modules for computers.

Why analog and not digital?

Analog is a real-time control signal associated with voltage. Digital control is based on discrete time intervals, comparing and manipulating two digits (0 and 1) or combinations according to a set of instructions. Since analog control is real-time, it provides a faster response time to command and feedback signals. The electronics in the LS System responds in less than 100 microseconds (100 μs = 1/10,000 seconds = 0.0001 seconds).

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Frequently Asked Questions

What is hysteresis?

Hysteresis in a pneumatic or hydraulic valve is the difference between the valve's output flow while increasing or decreasing from one level to another and back to the same point. This means that the system behaves differently going in one direction than it does going in the opposite direction. Designers try to minimize hysteresis to improve system accuracy. command signal and the actual position either going up to or coming down to the desired position. The LS System's infinite linear proportionality and trapezoidal command signal virtually eliminates hysteresis.

Why is clean air important and how do I get it?

As a compressor generates compressed air heat and water are created and some dust is ingested. Typically, the heat, water and dirt are reduced or eliminated by the manufacturing facility's drying and filtering system. However, some water and dirt can be left in the air as it travels through the facility. Since most facilities use galvanized piping to transport the air the water can cause the piping the rust and the scale to enter the air stream.

While the servo-valve's linear force motor is strong enough to shear most dirt in the system, the particles could damage the spool and affect the system's proportionality. Therefore, we recommend the use of a filtering system before the valve inlet. This filtering system should consist of a 5-micron pre-filter and a 0.3-micron coalescing filter.

What is the life expectancy of the system?

Life expectancy whether measured in cycles or years is dependent on your application's operating conditions and parameters. However, Enfield Technologies has original servo-pneumatic control systems still being used 10 years after they have been installed and some have been measured in excess of 140 million cycles.

What about stiction?

Stiction is a friction bond (static friction) between two movable surfaces that requires an initial force to break one surface free from the other to start moving, and this stiction friction is greater than the friction of an item in motion. This is what causes the initial jolt when you slide something on a table top, and it is why once you start the item moving you need as much force to keep it moving as you did to get it started. This problem is exacerbated when heat and oil builds up to coat or "vanish" the surfaces and it seals in a valve or air cylinder. This is not a problem with LS System valves because the spool has no seals, as it rides on a precision-machined air bearing. Since our servo-valve is designed to operate with non-lubricated air this problem should not occur under normal operating conditions.
See clean air question.

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ENFIELD TECHNOLOGIES

Press Release

Design Engineering Show

Date: February 18, 2004

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Location: Design Engineering Show **Booth:** 4805

Enfield Technologies Debuts and Demonstrates High-Speed Advanced Servo-Pneumatic Control Systems at Design Engineering Show.

Trumbull, CT – Enfield Technologies is proud to announce their participation in the 2004 Design Engineering Show during National Manufacturing Week in Chicago, IL on February 23rd to 26th. "This participation marks the launch of our new marketing campaign and we're excited to be here," says R. Edwin Howe, President of Enfield Technologies, "We have developed four hands-on, interactive and entertaining exhibits that demonstrate how our LS System helps automation designers control position, pressure, force, flow and velocity. These systems will be of particular interest to designers of industrial machinery, product testing equipment, and special effects animations.

The interactive displays include: position control, pressure control, force control and flow control. Position control is the most universally understandable control objective. The position control exhibit allows the show attendee to position a cylinder with a very smooth, accurate, and quiet motion. The cylinder's integrated position feedback sensor closes the command loop and is connected to a digital readout that allows to attendee view the command signal and the actual position.

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Press Release

Design Engineering Show

Pressure control is demonstrated using a pressure vessel. First, the attendee attempts to control the tank pressure manually. Next, the attendee can switch to automatic control, and set and vary the tank pressure between 20 and 100 PSI in 1 PSI increments. In this mode, they can use the manual controls to simulate a system leak or unknown pressure disturbance and see how the LS System immediately responds to keep the tank at the desired set pressure.

Force control is typically found in fatigue testing and production operations such as stamping and applying laminates. Using a laptop computer connected to the LS System via a USB interface, the attendee can vary the desired force using an on-screen slider. The demonstration uses a large spring so the attendee can see the compression and relaxation created by the LS System's management of the force command.

Using Bernoulli's principle, Enfield Technologies demonstrates how the LS System controls flow by floating a ping-pong ball in a column of air. The attendee positions their hand over a reflected infrared sensor. As the attendee moves their hand closer to or farther away from the sensor, the LS System adjusts the amount of airflow accordingly which synchronizes the ping-pong ball's height to the attendee's hand height.

A multi-channel oscilloscope is available for connection to any of the exhibits to better visualize the high speed and precision of the LS System. Attendees can have a print out of the captured traces or they can have the traces immediately emailed to them.

In addition to the above displays Enfield will preview three new product developments that will enhance the ability of designers to significantly improve their applications. These products include a command signal ramp conditioner, sensor calibration circuitry and a beta design of an integrated actuator. The command signal ramp conditioner modifies the characteristics of the command signal by changing the up and down slopes of the

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command signal for gradually opening and closing of the servo-valve. A variety of preset slope rates are available to choose from. The command signal ramp conditioner allows the system to be tuned to avoid dynamic overshoot, and it is ideal for helping conserve energy (electricity and compressed air).

The sensor calibration circuitry adjusts the offset and span of an analog sensor. This is required because analog sensors are not zero based. The circuitry calibrates the offset to zero when the device being controlled is at its minimum state and adjusts the span to 10 volts at its maximum state.

The beta design of the integrated actuator showcases an upcoming Enfield Technologies product designed to simplify the installation, use, and maintenance of servo-pneumatics. The demonstrated system combines the functions of a servo-pneumatic valve, a pneumatic actuator, and a position sensor – all typically scattered – in an clean, encapsulated, easy to use, and elegant looking design similar to that of an electric actuator. The integrated actuator has a power/signal cable connector along with air in and exhaust ports for a simple plug-and-use operation. The exhaust port enables exhaust to be routed away from the actuator for clean-room use. The integrated actuator operates very smoothly and quietly with no overshoot or jitter.

* * *

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ENFIELD TECHNOLOGIES

Press Release

Website Launch Announement

Date: February 23, 2004

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Enfield Technologies Launches NEW Ecommerce Website to Better Service Automation Designers.

Trumbull, CT – Enfield Technologies is proud to announce the launch of our NEW ecommerce website. This site is intended to inform, educate and communicate with designers of industrial automation, product testing and animation. The site was developed after numerous interviews with current and potential customers. "They told us that they wanted a website that was easy-to-navigate, that quickly provided the necessary product information and specifications to design an servo-pneumatic control system, and that gave them the ability to purchase and track shipments," said R. Edwin Howe, President, "I believe we have accomplished this and went even further."

"We have given customers an online account management system," says Howe, "It allows customers to place orders, review their account status and purchase history, track shipments, and establish and maintain customer service cases. In today's global economy the Internet is providing us an opportunity to improve customer relations and extend our market reach. Because the handling multiple currencies can be fraught with problems, we eliminated the need for letters of credit by accepting American Express, MasterCard and VISA. The ability to manage customer service inquiries online is better than email alone

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Press Release

Website Launch Announcement

because our customers can track their cases and the information is captured in our enterprise management software which helps us monitor and improve customer service performance. These online features are particularly useful for our overseas customers in other time zones who may need detailed account information outside of our normal office hours."

The web site will continue to improve, with a second phase scheduled to provide access to downloadable CAD files and an expanded suite of technical and educational material.

For the media, we have developed a secure section so you can view and download information on Enfield Technologies, press release, case studies, white papers, photos, etc. Just fill out our simple form and we will send you a user name and password.

Customers and media can begin their Enfield Technologies experience by visiting us at www.enfieldtech.com

* * *

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ENFIELD TECHNOLOGIES

Press Release

New Product

Date: February 23, 2004

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Enfield Technologies Introduces High-Speed, Advanced, Servo-Pneumatic Control System

Trumbull, CT – Enfield Technologies is proud to announce the introduction of our LS high-speed, advanced servo-pneumatic control system that helps automation designers control position, pressure, force, flow or velocity in either open- or closed-loop applications. The LS System is compromised of a dedicated device controller and a 5-ported, 3-position, closed-center directional valve for a unique yet simple and easy-to-use package.

The systems' multiple feedback design gives the designer more control over their applications. The device controller requires a minimum ± 12Vdc at 25 Watts or 1.0 Amp power source, and accepts a 4-20 mA, 0-10 Vdc or ±10Vdc command signal input from a variety of sources including PLCs and computers. Its convergent controller circuitry provides real-time command and feedback signal monitoring with a <100 microsecond (μs) response time. It has active valve current feedback, which monitors the linear force motor's position and immediately corrects external disturbances at the valve before the system sees them. It is rated for operating temperatures from -13°F to +187°F (-25°C to +85°C).

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Press Release

New Product

Optional sensor signal conditioners are available. The sensor signal conditioner provides amplification and linearization for either two individual or one differential low voltage level pressure or force sensors. For example, with differential pressure measurement an additional feedback path can be provided for those applications requiring more stability under varying load conditions. The command signal ramp conditioner modifies the characteristics of the command signal by changing the up and down slopes of the command signal for gradually opening and closing of the servo-valve. This allows the system to be tuned to avoid overshoot, and it is ideal for helping conserve energy (electricity and compressed air) by matching the servo-pneumatic control system to the mechanical system dynamics.

The servo-pneumatic valve uses a directly coupled linear force motor and lapped-spool-and-sleeve construction for fast, smooth, quiet, stiction-free operation. This patented design provides infinitely variable and truely linear proportionality with almost zero hysteresis. The valve's response time from closed-center to fully open in either direction is 2.5 milliseconds, and it consumes less than 1 Amp to complete this operation. The valve is available in three sizes 10-32 UNF, 1/8" NPT and 1/4" NPT with a flow capacity up to 46 SCFM (985 Nl/m). The valves are capable of controlling pneumatic actuators up to 5" (125mm) bore. The LS System is rated for use with clean, dry, non-lubricated air or inert gases up from 28" Hg vacuum to 150 PSI (10bar), and ambient temperatures from -10^{o}F to +115^{o}F (-23^{o}C to +46^{o}C). The valve receives it command signal through a 3-pin pico M8 female, 24AWG cable.

While the system is designed for proportional pneumatic control it can be used in speed applications with a total cycle time of 5ms for a complete open and close of one port. That's 4 to 7 times faster then the typical solenoid operated valve. Its trapezoidal command curve eliminates the end of stroke shock typically associated with high-speed ... bang-bang ... applications.

The LS System is being used in a wide variety of applications and is well-suited for industrial automation, product testing and animation.

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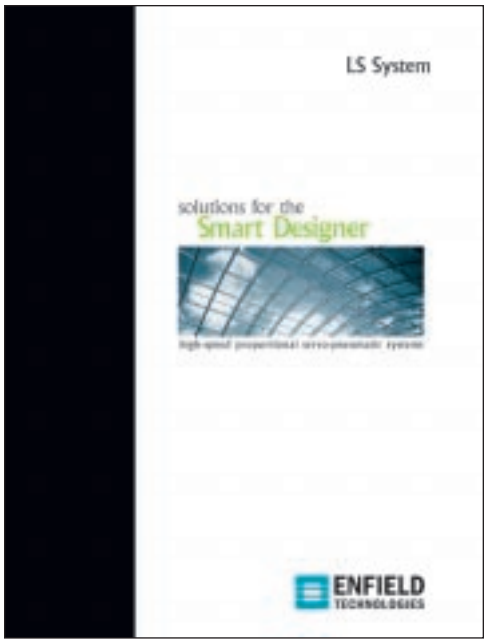
Enfield Technologies Releases NEW Brochure for Automation Designers



Trumbull, CT – Enfield Technologies is proud to announce the release of a NEW 8-page brochure on our LS high-speed, advanced servo-pneumatic control system that helps automation designers control position, pressure, force, flow or velocity in open- or closed-loop applications. The LS System is compromised of a dedicated device controller and a patented 5-ported, 3-position, closed-center directional valve for a unique yet simple and easy-to-use package.

The brochure provides the automation designer with product specifications and technology highlights for our device controller, sensor signal conditioner and the servo-pneumatic valve's 3 sizes along with a series of case study vignettes designed to highlight how the LS System is being used in real-life applications. It graphically shows how the LS Systems' specialized circuitry and design provides multiple feedback for enhanced application control and how our

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Press Release
Catalog

patented linear force motor technology outperforms typical solenoid control systems. The LS System brochure explains what proportional control means, the difference between open- and closed-loop, and how our linear force motor technology provides smoother, faster and better control compared to solenoid technology. Additionally, there are graphics to help the designer understand the system.

The LS System brochure is available in printed form by calling 800-504-3334 or in Adobe Acrobat PDF format via download from www.enfieldtech.com

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