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Magnetostrictive, Absolute, Non-contact
Linear-Position Sensors



Wayne Engineering Improves Trash Collection Vehicle Efficiency with "Smart" Cylinders Case Study

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MH-Series Model MH position sensor



Smart Cylinder with Model MH position sensor

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MORE THAN MEETS THE EYE

The average residential trash collection vehicle in the U.S. is responsible for collecting trash from approximately 1,200 homes a day. Commercial vehicles, while dealing with fewer stops, encounter situations



that are just as stressful and fast paced. In this industry, efficiency is highly important. Owners and operators are always looking for ways to minimize the time spent collecting from every can or bin – without compromising the stability of the operation, the safety of the operator or the structural integrity of the vehicle itself.

In the 1970's, Wayne Engineering introduced the Curbtender ASL, which is generally considered as one of the first automated side loader vehicles in the industry. In early 2012, the company introduced the next generation of the the Curbtender, the "G4." Available in body sizes between 20 and 31 cubic yards, the new trucks utilize a seven foot reach lift arm rated up to a 2,000 pound lift load. The operator, using a joystick control, is able to easily collect without leaving the cab.

"In designing the new vehicle, we took a critical look at every system involved in the trash collection process," Scott Kanne, Executive Vice President at Wayne Engineering, explained. "Nothing was out of bounds. Our goal was to design a truck that allowed for faster collections with greater operating precision. To do this, we looked at everything from the fuel mileage of the vehicle to the stability of the collection arms."

One of the biggest changes came in the structure of the arm itself. Traditionally, collection arms used basic external proximity switches and mechanical arm to extend, retract and lift cans. Beyond those simple tasks, the operator had no control or position feedback regarding the operation of the machine.

That changed in 2011 when Kanne, while meeting with Kelly Greenfield, Design Engineer, at Rosenboom. Greenfield proposed integrating a "smart" cylinder into the design of the vehicle. Developed with MTS Sensors, the smart cylinder contains a hermetically sealed Temposonics® MH-Series linear positioning sensor embedded inside the cylinder. Using advanced electronics and computer controls, a vehicle's operator can precisely control the position of the arm in increments as small as a few microns.

In addition to allowing extreme precision in operations, integration of the smart cylinders enabled faster operating speeds. According to Kanne, Wayne Engineering was able to reduce cycle times from eight to nine seconds to approximately seven seconds per operation.

"When you are dealing with more than 1,000 operations a day, every second counts," he said. "A faster cycle time means faster pickups and less time on the route. Our customers are saving fuel and operating more efficiently than ever before."

One of the early concerns in development was that, with higher speed operations, there would be more stress on the vehicle and loading equipment. Traditional systems were limited because faster operations meant abrupt stops and shocks in the process.

By using a sensor that operates in the sub-millimeter range, and a custom manufactured cylinder designed specifically for the application, this was not an issue.

Magnetostrictive sensors use absolute positioning, meaning the signal sent to the electronics in the vehicle are always in sync with the location of a magnet within the cylinder, even if there are momentary power losses or shutdowns. Combined with the inherent precision of the application, these factors make the technology ideal for this application.



"The arms operate smoother and more reliably with this technology incorporated," Kanne said. "The smart cylinders from Rosenboom and MTS Sensors were the perfect finishing touch for the new G4 vehicle design." There are currently more than 3,000 Curbtenders in operation in the U.S., with many new G4 models on order and shipping soon.

In addition to the Curbtender G4, Wayne Engineering has incorporated the smart cylinders into the design of the Titan Ecoforce front loader commercial class vehicles. The Titan Eco Force front loader is a robust and durable collection vehicle that can endure the rigors of the Garbage and Recycle industry, yet its light weight design allows haulers to carry extra payload and maximize the return on investment.

"While cycle speed is less of a concern in the Titan, those vehicles have to be much more durable." Kanne said. "With the incorporation of the smart cylinders into those vehicles and the more precise, fluid controls they bring, we have taken a lot of the stress and banging out of the equation." The smart cylinder is a joint initiative developed as part of the MTS Integration PARTNER™ program. Working with exact specifications from Wayne Engineering, Rosenboom designed custom cylinders to meet the application. The Temposonics MH-Series sensors incorporated into the design a technology known as magnetostriction to provide the level of control desired.

Magnetostrictive-based sensors work by inducing a sonic strain pulse in a specially designed magnetostrictive waveguide by the momentary interaction of two magnetic fields. One field comes from a movable permanent magnet which passes along the outside of the sensor tube, the other field comes from a current pulse or interrogation pulse applied along the waveguide. This interaction produces a strain pulse, which travels at sonic speed along the waveguide until the pulse is detected at the head of the sensor. The magnet's position is determined with high precision by measuring the elapsed time between the application of the interrogation pulse and the arrival of the resulting strain pulse. Consequently, accurate non-contact position is achieved with absolutely no wear to the sensing components.

ABOUT MTS SENSORS:

MTS Sensors, a division of MTS Systems Corp., is the global leader in the development and production of magnetostrictive linear-position and liquid-level sensors.

MTS Sensors Division is continually developing new ways to apply Temposonics® magnetostrictive sensing technology to solve critical applications in a variety of markets worldwide. With facilities in the U.S., Germany, Japan, and China, MTS Sensors Division is an ISO 9001 certified supplier committed to providing customers with innovative sensing products that deliver reliable position sensing solutions.

ABOUT ROSENBOOM

Rosenboom engineers and manufactures custom hydraulic cylinders trusted by industry leaders in refuse, construction, agriculture, fire rescue, transportation, forestry and several other industries including the military. Rosenboom produces cylinders at its headquarters in Sheldon, Iowa along with manufacturing facilities in Spirit Lake, Iowa, Bowling Green, Ohio and Yantai, China. Custom telescopic and single stage cylinders are designed specific to the customer application in bore sizes from 1-inch to 12-inches, stroke length up to 24-feet long for single stage, and operating pressures up to 5,000 psi. For more information on Rosenboom, visit www.rosenboom.com.

ABOUT WAYNE ENGINEERING:

Wayne Engineering is a leading manufacturer of chassis-mounted productivity solutions for the solid waste industry. Wayne Engineering seeks to produce equipment that has the best quality, dependability and productivity in the industry. Their engineers and support team are dedicated to continually developing and testing new solutions and their ultimate goal is to deliver the product, service and performance that every customer demands. For more information, visit www.wayneusa.com.

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