

Improving Operational Speeds in Agricultural Equipment White Paper

Document Part Number
551655 Revision A



Model MH sensor



Model MH in-cylinder position sensor

By Luka Korzeniowski, Technical Marketing Manager of MTS Sensors

The past few years, original equipment manufacturers (OEMs) have made tremendous strides integrating advanced automation techniques into their machines. With the use of electronics and electro-hydraulics, every aspect of the machine operation can now be monitored and controlled, including: multifunction steering, implement depth, and even the suspension in the seat. These control improvements have shown measurable improvements in vehicle and operator productivity while reducing operating costs.



This greater control is possible due to a combination of broad base adoption of electro-hydraulics and improved performance of positioning sensors designed specifically for the off-highway market. The level of control offered by these sensors and electro-hydraulic systems can have dramatic effects on machine operations resulting in faster positioning of a hydraulic cylinder at higher operational speeds. The resulting increased productivity provides significant benefits across the industry. Seeding, planting and fertilization are faster, more accurate, and produces less waste or overage. Harvesting is more efficient through greater control and the ability to automatically adjust to terrain, crop or weather conditions.

Lifting and controlling the height of a harvester head, for instance, has a direct impact on the maximum speed of the machine itself. By automatically adapting to terrain or environmental conditions faster, the machine can continue running at or near top speeds for longer periods of time. Also, precision turns mean getting back to the rows faster, reducing total operation time and saving fuel.

Currently, the speeds at which most hydraulic systems operate are limited because of a need to avoid damage to the equipment itself. Some of the avoidance techniques have been: to reduce the speed of the hydraulic systems, or through the use of external mechanical or internal hydraulic cushioning. Reducing hydraulic system speed has a direct impact on the machine operational speeds. External mechanical cushioning involves a sudden deceleration of a cylinder's operations at each end of the stroke, such as through the use of physical stops. Internal hydraulic cushioning requires complex internal porting and machining of the cylinder which has to be tailored to individual functions. The latter of these methods induce high levels of mechanical shock or pressure spikes in the system in an effort to slow the system.

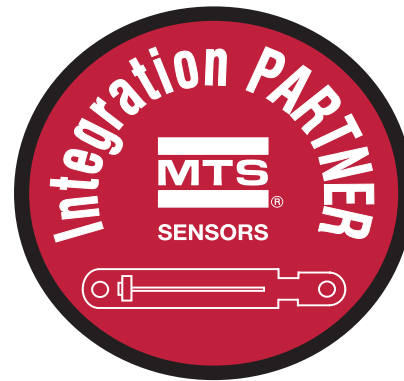
Enhancing the speed of the hydraulic cylinders, without risking damage or compromising safety, requires the integration of advanced electronic acceleration and deceleration methods. Combining sensors with electro-hydraulics makes this a viable alternative to existing methods. Utilizing advanced linear positioning sensors makes it possible to predict and control acceleration and deceleration rates using optimal start and stop points.



Electronic acceleration and deceleration methods have already been proven beneficial in the waste management industry. Manufacturers of waste handling trucks have been installing robotic arms, powered by hydraulic cylinders with electronic acceleration and deceleration methods, for several years. On average, they have been able to reduce time by several seconds per operation (in this case, each time the arm is used to lift, dump and return a waste receptacle or recycling container in curbside pickups). In residential areas, where one vehicle is responsible for more than 2,000 pickups a day, the benefits can add up to hours of time saved per day.



MTS Sensors has created an industry partnership program for the integration of its Temposonics® sensors in hydraulic systems. MTS Sensors, cylinder manufacturers and system integrators, work together to develop solutions that meet OEM needs. The MTS Integration Partner program brings together the position-sensing technology and expertise of MTS Sensors with best-in-class hydraulic cylinder manufacturers worldwide, enabling cost and performance-optimized smart cylinder designs. MTS Sensors and the system integrator partners then work with OEMs to develop new control applications on their machines. The well-developed partnership with expertise in position sensing, hydraulics design and control systems, results in a faster development cycle with a cost-optimized system solution.



MTS Sensors has transferred the necessary technology and knowledge gained to the agricultural industry through the introduction of advanced measurement and control techniques. The same concept can be applied to practically every aspect of the machine. Faster operations, without compromising safety or risking injury to the vehicle, will result in the same kind of improvements - providing increased productivity, better fuel efficiency and less wear and tear on the vehicle.

Using smart cylinder technology, advanced sugar beet harvesting equipment can automatically perform every task needed in the field. This includes topping, lifting, collecting and depositing crops without human intervention. Automated depth control regulates the lifting range on each side of a planted row. Hydraulically-driven, vibrating plowshares penetrate the soil, catch the beet just below the top and pull it from the earth. The shares run across the ground at a precisely controlled height – as close to the ground as possible. The height of the shares is automatically adjusted using smart cylinders with linear positioning sensors.



Advanced electronic control and linear positioning technologies inside the hydraulic cylinder are standard equipment on many agricultural machines today. The MTS Integration Partner Program brings together MTS sensors, cylinder manufacturers, and developers of electronic systems, to bring a complete solution to the OEM's control needs.

For more information about linear positioning sensors and the MTS Integration Partner Program, visit <http://www.mtssensors.com>.

ABOUT THE AUTHOR:

Luka Korzeniowski is the MTS Sensors technical marketing manager for the mobile hydraulics industry. Korzeniowski is responsible for overseeing marketing for construction, agricultural, mining, and other on and off highway equipment. He and his team work closely with manufacturers of hydraulic cylinders and system integrators, to provide reliable position sensing solutions. Prior to joining MTS Systems Corp., Sensors Division, Korzeniowski held positions with companies including Caterpillar and AMP Incorporated. He has more than 19 years of experience in electrical component and construction equipment development. Korzeniowski's experience includes new product development and product management for electrical component and systems, and engine and engine systems. Korzeniowski is a certified 6 Sigma Black Belt (DMAIC and DMEDI).

He holds a Bachelor of Science – Physics from Wake Forest University, Winston-Salem, NC.

ABOUT MTS SENSORS:

MTS Sensors is a global leader in sensing technologies and solutions that enable feedback control automation and safety applications. MTS Sensors, a division of MTS Systems Corporation, serves its global customers with a focus on regional support to provide innovative and reliable sensing solutions. Through its research, development and production of various products, MTS offers rugged sensors for harsh environments and in-cylinder and external mounting options for easy installation. MTS mobile sensors are commonly used for agriculture, construction, safety and material handling applications.



LEGAL NOTICES

Document Part Number:
551655 Revision A (US) 07/2014

MTS and Tempsonics are registered US trademarks of MTS Systems Corporation.
All other trademarks are the property of their respective owners.
Printed in USA. Copyright © 2014 MTS Systems Corporation. All Rights Reserved in all media.

LOCATIONS

USA
MTS Systems Corporation
Sensors Division
3001 Sheldon Drive
Cary, N.C. 27513, USA
Tel. +1-919-677-0100
Fax +1-919-677-0200
info.us@mtssensors.com
www.mtssensors.com

GERMANY
MTS Sensor Technologie
GmbH & Co. KG
Auf dem Schüffel 9
58513 Lüdenscheid, Germany
Tel. +49-23 51-95 87 0
Fax +49-23 51-5 64 91
info.de@mtssensors.com
www.mtssensor.de

JAPAN
MTS Sensors Technology Corp.
737 Aihara-machi,
Machida-shi,
Tokyo 194-0211, Japan
Tel. +81-42-775-3838
Fax +81-42-775-5512
info.jp@mtssensors.com
www.mtssensor.co.jp