

Ameridrives

Bauer Gear Motor

Bibby Turboflex

Boston Gear

Delevan

Delroyd Worm Gear

Formsprag Clutch

Guardian Couplings

Huco

Jacobs Vehicle Systems

Kilian

Kollmorgen

Lamiflex Couplings

Marland Clutch

Matrix

Nuttall Gear

Portescap

Stieber

Stromag

Svendborg Brakes

TB Wood's

Thomson

Twiflex

Warner Electric

Wichita Clutch

Power Transmission Solutions for Autonomous Agricultural Vehicles



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Autonomous agricultural vehicles promise to increase productivity in farming, which is pushing rapid development of the technology. With multiple OEMs testing or delivering autonomous vehicles to market, new powertrain solutions are required to provide optimal application performance for the many classes of new vehicles. Altra Industrial Motion Corp., a global power transmission expert, offers a suite of innovative solutions designed to meet the needs of each vehicle requirement.

Utilizing laser or GPS tracking, it is now possible for vehicles to carry out tasks such as cultivation and harvesting autonomously. Technology such as swarm robotics, which allows multiple robots to operate collectively via interactions, is ensuring that autonomous vehicles can operate efficiently on even the largest farms. However, with autonomous technology beginning to emerge, multiple powertrains are currently required to cover the range of vehicles offered by each OEM. OEMs need to specify specialized power transmission components to meet the requirements of the complex vehicles of the future.

Small autonomous electric vehicles

A growing trend in the agricultural sector is to make use of small, standardized electric vehicles that can be fitted with a wide variety of implements. This allows for a single robot to carry out multiple tasks efficiently. Depending on batteries, these vehicles can typically operate for up to 6 hours in the field.

Ensuring power efficiency is key to the viability of the vehicle, so reducing the power consumption of systems on the vehicle is extremely important. Traditionally, an electromagnetic brake requires a constant power supply to stay open. Optimizing the operation of the braking system can therefore deliver large energy savings.

Warner Electric, a leading brand of the Altra Industrial Motion Corp., has developed a solution to tackle the power requirements of electromagnetic brakes with its SSPB pulse brake. The brake is ideal for the rigors of stopping to avoid obstacles or conduct implement changeover. A global provider of electromagnetic brakes, Warner Electric has built additional energy efficiency into the SSPB.

The SSPB differs from other electromagnetic brakes in that it opens and closes whenever there is a pulse of current. The result is that power consumption by the braking system is greatly reduced, ensuring electric vehicles with limited battery storage can maximize time in the field.



The SSPB brake from Warner Electric is highly efficient and greatly reduces power consumption during operation.

Diesel autonomous vehicles

With the limitations of battery technology, full electrification is counterproductive past a certain vehicle size and power output. To power a 250 bhp tractor in the field for 8 hours would require a battery

approximately 15 tonnes in weight – which negates any efficiency or practicality advantage full electrification could possibly offer.

This means that combustion engines will be present on larger farm machinery for some time to come. For an autonomous vehicle, this places the emphasis on the processing power to manage engine performance. Engine power output needs to be constantly managed to accommodate changes in terrain, crop flow and soil conditions – all while allowing for overall fuel efficiency. Rationalizing this data from the vast array of sensors requires considerable onboard processing power for information to be delivered to the engine management system. Technologies are required to ensure predictable engine operation to reduce the processing power required to operate the vehicle.

Engine management is a speciality of Jacobs Vehicle Systems, another leading brand of Altra Industrial Motion Corp. Already well established in on-highway commercial vehicles, Jacobs Vehicle Systems works directly with engine OEMs to incorporate engine braking, variable valve actuation and cylinder deactivation technologies seamlessly into engine designs.

Variable valve actuation allows the accurate control of valve motion, allowing optimal tuning of the engine. This helps to lower fuel consumption, optimizes compression ratios, improves transient response, reduces emissions and crucially, delivers the predictable engine behavior vital to combustion-powered autonomous vehicles.

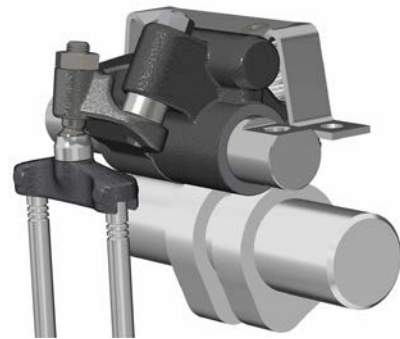
By considering such technologies in the engine design stage, engine OEMs can deliver the repeatability and predictiveness of engine behavior required of the latest autonomous vehicles.

Diesel/electric hybrid autonomous vehicles

The happy medium between full electrification and diesel power is the hybrid powertrain. Agricultural OEMs are looking to improve environmental friendliness in the areas where hybridization fits the size and power requirements of the vehicle.

However, flexible components are needed to accommodate the requirements of both power trains. Luckily Stromag, a leader in industrial drivetrain components and a brand of Altra Industrial Motion Corp., offers its range of Two-in-one hydraulic or electromagnetic clutch/flexible or dampening coupling combinations. Available as a plug and play assembly – for hybrid drive chains the 2in1 is mounted between the combustion engine and electric motor. By engaging or disengaging the clutch, the vehicle can operate under either diesel or electric power as is required.

As hybrid autonomous vehicles contain batteries, limiting overall power consumption is also an important factor. By reducing the power requirements of auxiliary systems such as air conditioning and hydraulic



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Hybrid power trains need flexible components to accommodate the requirements of both power trains. Such as Stromag's range of Two-in-one hydraulic or electromagnetic clutch/flexible or dampening coupling combinations.

pumps, efficiency gains can be attained. Warner Electric provides a wide range of electromagnetic clutches to offer this precise on/off functionality – ensuring available power is used as efficiently as possible.

An innovative power transmission solutions provider

To maximize the market opportunity of the growth of autonomous agricultural vehicles, OEMs need to select a supplier that offers innovative power transmission solutions that meet each individual drivetrain requirement. Altra Industrial Motion Corp. offers this capability on a global scale, with each leading brand providing innate knowledge regarding certain aspects of diesel, hybrid and electric powertrains. With autonomous agricultural technology very much in its infancy, this global capability means that products keep pace with the different powertrain approaches inherent to the introduction of this new technology.



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