



Electric servo drives prove themselves in outdoor use

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There are many cost-effective ways of using electric drive technology in agricultural and construction machinery. Thanks to this technology, process control and thus productivity are increased due to greater efficiency of the electric drive technology. Recuperation of kinetic energy and mechanical speed decoupling of the combustion engine enables fuel to be saved, which in return protects the environment. With its double inverter JMM-5000, Jetter has extended its product range for the automation and electrification of agricultural and construction machinery. The company's more than thirty years of experience in industrial applications also benefits mobile automation.

The double inverter, which is designed as a four-quadrant inverter, can be integrated into the overall system. It can be powered with an AC or DC supply. For self-propelling harvesting or construction machinery, the double inverter can also be provided with a DC/DC output, so that the vehicle can be supplied with 12 V_{DC} or 24 V_{DC} and up to 400 A straight from the vehicle battery. The inverter is available with

power ratings from 5 kW to 80 kW and is used as a wheel or ancillary drive.

It is stackable - i.e. the inverters can be installed one above the other, because all power, control and water connections are located on one side.

The JMM-5000 was used in the field for the first time in the middle of 2012 and has therefore already proven its suitability for use in harsh environments.

The efficiency of electric drive systems is, alongside numerous other factors, heavily dependent upon how long the machine is used. If the machine is not used for very long, the process improvement must predominate in order to justify electrification. Improved process control means fewer downtimes, optimal filling of the machine, exact feed length that is optimal for fodder use (e.g. for biogas plants, as fodder, etc.), low-loss harvesting of the fodder, etc. The speed decoupler allows each drive to run independently of the speed of the combustion engine, enabling it to be operated and held at its most fuel-efficient point.

An energy management system tailored to the machine ensures energy

distribution. For example, if kinetic energy is recuperated, the energy management system ensures that this energy is stored or used elsewhere in the machine. In this way, the load and speed of the combustion engine is kept constant and energy is saved.

This stored energy can be used for boosting, i.e. at times of peak loads, so that the combustion engine is held at its optimum consumption point.

The swivel drive on an excavator is an example. The excavator fills its shovel in the loading process, swivels it towards the dumper or truck and tips the contents out in the unloading process.

In doing so, the structure must be accelerated and then decelerated after approx. imately 90°. This braking energy is recuperated/stored in the process and used for acceleration. This reduces the energy required by the swivel drive by about 50 %.

Wheel drive on a potato harvester

In this application, the energy is generated by a PTO (power take-off) and passed ▷

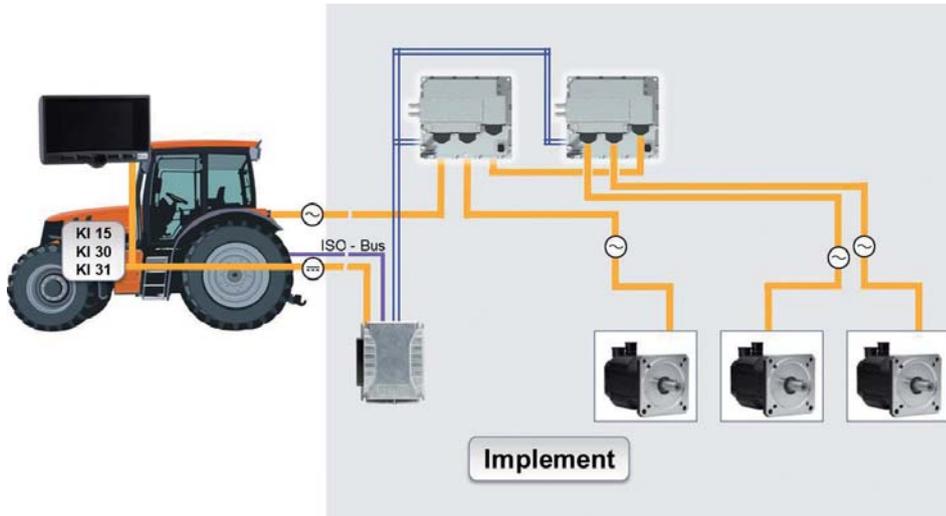


Figure 1: Example configuration of JMM-5000 with a DC supply

to the implement via a specially designed connector. The PTO is driven via the front PTO shaft of the tractor. The VDC generated by the PTO is stored in the DC link of the double inverter and passed to two permanently excited synchronous motors. It was specially designed for this application by Jetter and has a high power density.

motor is monitored by thermocouples. Thanks to its high power density, the 30 kg motor delivers 27,5 kW to each wheel. The implement is therefore driven via both wheels with 55 kW. The planetary gear unit used has a transmission ratio of 1:65 and can be switched off while moving the implement from one site to another.

different film types used for round bales.

This can be done more easily with electric drives, which can be more finely controlled, than with hydraulic drives. In electric drives, the torque is detected via the current that flows to the motor and is set and monitored to prevent the film from tearing. If the torque changes, the baler can be brought to an immediate stop within 450 milliseconds, avoiding any tears in the film. This saves valuable downtime.

“Saving energy has to go hand in hand with increasing efficiency”, which all companies have realized by now. In the field of drive technology in particular, a high amount of potential exists in this direction. Experiences from the area of industrial automation will only continue to help in the area of mobile automation to a limited extent, as the conditions for outdoor use are mostly completely different.

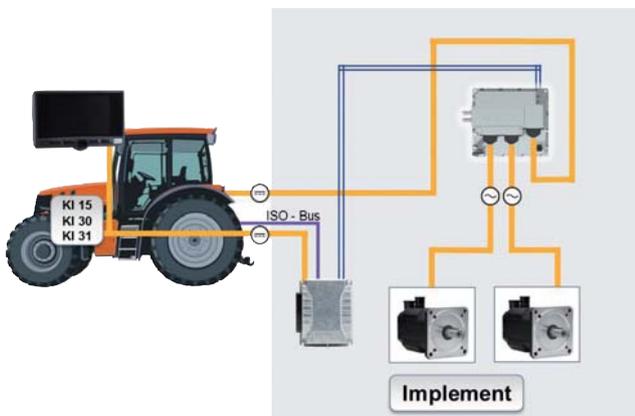


Figure 2: Example configuration of JMM-5000 with an AC supply

The software implemented in the double inverter controls the speed, so that the implement runs synchronously with the tractor. It also monitors the power and torque to avoid the creation of any extended overloads (the double inverter can be overloaded to 150 % for short periods) and prevents the wheels from "slipping" in poor surface conditions.

A resolver is used to monitor the motor speed. The temperature of the

Winder unit of a round baler

Just like in the potato harvester, the electrical energy is generated with a PTO. Important for the potato harvester is the improvement in the energy balance. In the winder application, on the other hand, the focus is on improving the process, because the viscosity of the film changes depending on different weather conditions and the



Figure 3: Schematic of a winding unit on a round bale press

Summary

Electric drive technology has established itself in industrial automation. Mobile automation hasn't. When it comes to controlled drives for mobile machines, this industry used to rely on hydraulic systems. There is a great number of mobile implements and vehicles though for which the application of electric drive technology is a good idea. Jetter AG now brings the double inverter JMM-5000 (JetMove Mobile 5000) to the market, especially for such applications. It fulfills the particularly high requirements for outdoor use with regard to temperature, seal, vibration, dirt and moisture protection.