

SEPTEMBER 2017

iVT

INTERNATIONAL
INDUSTRIAL VEHICLE TECHNOLOGY

WORLD-FIRST INNOVATIONS

- | Autonomous road-roller concept
- | The OEM using Google Glass
- | Fully self-driving forklift launched

Smarter tech now

How CANbus is evolving
to meet new demands

**10 BEST
NEW VEHICLES**
AT AGRITECHNICA 2017



Diesel killers

The birth of the electric tractor

**BIGGEST ISSUE
EVER!**



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"The fact that the fair will soon be underway is very exciting. The work we have done in the two years since Agritechnica 2015 will finally come to fruition" p90



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The views expressed in the articles and technical papers are those of the authors and are not endorsed by the publishers. While every care has been taken during production, the publisher does not accept any liability for errors that may have occurred. *iVT International* USPS 018-627 is published quarterly, in February, June, September and November.

Annual subscription price is US\$104/£80. Airfreight and mailing in the USA by agent named Air Business Ltd, c/o Worldnet Shipping USA Inc, 155-11 146th Street, Jamaica,

NY 11434. Periodicals postage paid at Jamaica, NY 11431. US Postmaster: send address changes to *iVT International* c/o Air Business Ltd, c/o Worldnet Shipping USA Inc, 155-11 146th Street, Jamaica, NY, 11434. Subscription records are held at UKI Media & Events Ltd, Abinger House, Church St, Dorking, Surrey, RH4 1DF, UK. Air Business is acting as our mailing agent.

iVT International is protected by copyright ©2017. ISSN 1471-115X (Print) ISSN 2397-6349 (Online)



Published by
UKI Media & Events,
Abinger House, Church Street,
Dorking, Surrey RH4 1DF, UK
Tel: +44 1306 743744
Fax: +44 1306 742525
Ed. fax: +44 1306 887546
UKI Media & Events is a division of UKIP Media & Events Ltd
Printed by William Gibbons,
Willenhall, West Midlands, WV13 3XT, UK
Average net circulation for the period
January 1 to December 31, 2016: 10,355.



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FOREWORD

Electric vehicles are big news in the automotive world. Despite conservative predictions that public uptake of such technology will plateau, with more efficient diesel and petrol engines securing the future of fossil fuels for decades to come, government policy makers have other ideas. An opportunity to finally reduce our reliance on oil presents itself, and is being seized. In July, the British government announced that it will outlaw the sale of diesel- and petrol-only cars by 2040. And an 'arms race' has begun between automotive manufacturers now focused on outdoing one another with the best hybrid, all-electric and alternatively fueled solutions.

But what about the industrial vehicle world? As with the early days of automotive electric and hybrids, such powertrains in heavy-duty machinery have been met with a healthy dose of skepticism. Can they ever produce the required power levels? How long will a charge last and what happens if you need to recharge in the field? What about using them in locations with limited electrical infrastructure? Many such questions are still yet to be fully answered. But that hasn't stopped OEMs from pressing ahead with concept vehicles in both construction and agriculture – and even getting some to market. Bringing to mind the old adage – where there's a will, there's a way.

One such concept is John Deere's SESAM (Sustainable Energy Supply for Agricultural Machinery) tractor. It's a surprising vehicle in many ways – turn the key and a quiet

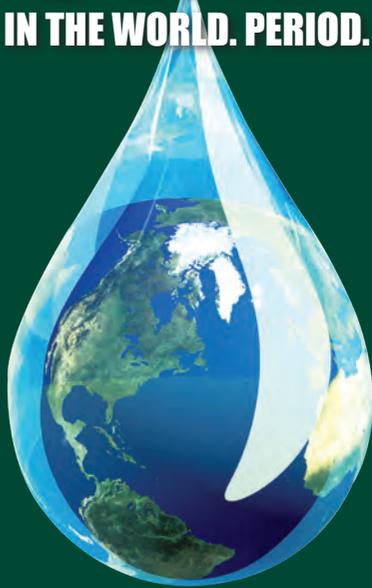
hum, rather than the loud chug of a diesel, greets you. Look under the bonnet and, instead of a greasy internal combustion engine, you'll find a huge bank of battery packs. Follow it into the field and you'll find it doing all the jobs of a traditional tractor its size, quietly and efficiently. It's just one of the projects being overseen by Prof. Dr Peter Pickel, deputy director of John Deere's European Technology Innovation Centre, who gives us the inside story on this, and his other new technological advances, from page 30.

It's just the beginning of the huge agricultural special you'll find in this, the biggest ever quarterly edition of *iVT* – inspired, of course, by the forthcoming Agritechnica expo being held in Hannover, November 12-18. Within our event preview (which starts on page 88) you'll find *iVT*'s 10 Best New Vehicles at the show. One of which was a big surprise when it was announced, just before we went to press: Fendt's e100 Vario is the world's first commercially available all-electric tractor. How does it stack up against John Deere's prototype? And is it really good enough to do its job? You decide, with our vehicle overview on page 100.

As far as innovation in electric drives for industrial vehicles goes, this is just the beginning. If you want to learn more about what's to come, visit *iVT*'s symposium, November 14-15 in Cologne – a direct train runs to Hannover! Find out more about this event on page 14.

Tom Stone, Editor, *iVT International*

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Pumps that control flow

ADVANCES IN PUMP TECHNOLOGY MEAN ACE PUMP CAN INCREASE OR REDUCE THE RATE OF OIL FLOWING TO THE MOTOR

▶ Agricultural sprayers were developed to apply liquid fertilizers, herbicides, pesticides and other crop inputs. Over the years, improvements to these machines have focused on application efficiency. Years ago, self-propelled sprayers were improved with the addition of a pulse width modulation (PWM) control valve that regulates oil flow of the spray pump, precisely controlling the application rate. PWM is a common type of control signal that modern rate controllers use to regulate the application rate. PWM signals have several defining characteristics including voltage, frequency and duty cycle.

Voltage and frequency are constant

The voltage of a PWM signal and the frequency, which can be set by the operator, are constant. Frequency sets the length of time each cycle lasts. Duty cycle is a variable calculated by the rate controller and defines the length of time the constant voltage is on during each cycle.

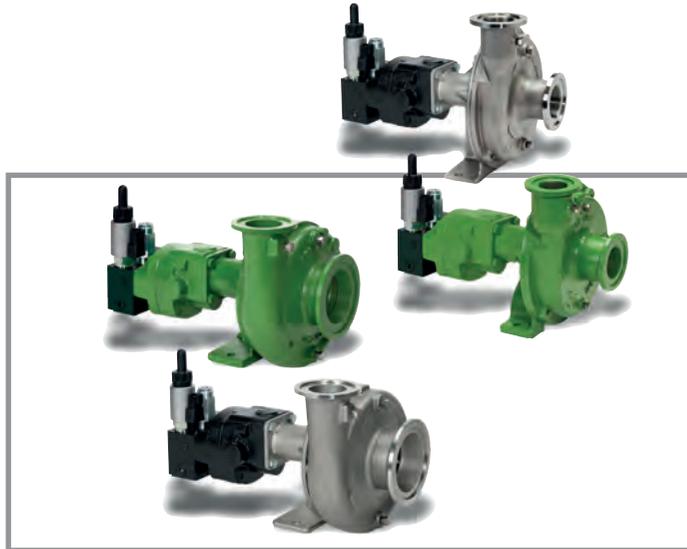
In Ace Pump's application, the PWM signal is used to open and close a 12V proportional valve. The proportional valve acts as a variable barrier that increases or decreases the amount of oil flow through the motor. This variable oil flow modifies the revs per minute of the pump/motor assembly, adjusting the overall application rate. The result is an instantaneous response to a change in the rate controller's required flow demand.

Precision control and application is becoming a greater focus these days. The fast response time of PWM valves offers a solution when used in combination with a rate controller.

Some of the latest-generation rate controllers require a PWM pump. These pump/valve combinations provide quick rate changes for constant and variable rate applications.

Pumps only run as fast as is necessary, minimizing horsepower requirements as well as wear and tear on the pump and other system components. This prevents excessive heat or foaming caused by large bypass flows.

All of Ace Pump's PWM-controlled products are designed for use on any closed-center hydraulic system. The valves have internal compensation to provide linear control curves, helping a broad range of rate controllers find the correct rate almost



LEFT: The new pumps include integrated pulse width modulated (PWM) control valves

BELOW: The Gemini dual-pump enables operation of two pumps independently

instantaneously. The 12V valve has an industry standard connector and includes a manual override for emergency situations where the control signal is lost, or to aid in troubleshooting hydraulic issues. Each PWM product is thoroughly tested to ensure rapid response out of the box.

Multiple application possibilities

Until recently, use of the PWM control valve was limited to self-propelled sprayers. But now the same PWM control technology used on self-propelled equipment can be implemented easily on pull-type sprayers and fertilizer applicators, thanks to Ace Pump's four new pump models with integrated PWM control valves.

The new pumps feature a two-valve design with a compensator spool to eliminate excessive hydraulic flow failures of the fixed clearance gear motor and further improve the stability of pump flow over the entire range of the PWM signal. Testing shows the application rate can be found in less than two seconds, even with a large change in the flow rate demand. These products also feature an anodized valve block for increased corrosion prevention.

Additional motors with integrated PWM valves are currently in the testing phase and will be available soon. In many applications today, especially planters, farmers run out of available hydraulic ports.

Attempts to run two pumps from one hydraulic source usually result in the flow going to one pump and the second one locking up. Farmers are forced



instead to use a smaller-capacity 12V pump, which offers only limited flow rates, with limited reliability. The Gemini dual-pump kit enables users to operate two Ace Pumps independently from a single hydraulic supply and control them manually or automatically with a PWM control signal. The kit was designed for maximum flexibility out of the box and can control any combination of Ace's popular FMC-HYD series pumps powered by its 204 or 206 motors.

Once installed on a planter or sprayer, it enables operators to quickly and easily dial-in two separate application rates. Oil may be supplied from one selective control valve or directly from the powered hydraulic supply. In addition to greater application accuracy, the kit gives applicators and farmers more flexibility in setting up their spray systems. **ivT**

The author is Bobby M Robinson Jnr, senior production engineer at Ace Pump Corporation



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