

The "leader of the pack" climbs with CAN

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The enormous increase in electronic systems of off-highway vehicles, together with more sophisticated demands on power and design, has raised plenty of new engineering challenges. Employing an electronic control system opens up new ways to implement mechatronic solutions. New functions can be realized by simply adapting the software. This guarantees a high degree of flexibility and extensibility, thus making the technology best suited for future industry requirements.

Reliability even under the extremely harsh conditions encountered by off-highway vehicles represents a specific challenge to technology. TTEControl-TTTech Off-Highway (www.ttcontrol.com) and Prinoth AG by Leitner Snow cooperated by equipping Prinoth's top-of-the-line "Leitwolf" (German for "leader of the pack" or alpha wolf) snow groomer with TTEControl's electronic control system. For reasons of safety and economy, this highly maneuverable snow groomer has been equipped with an advanced control system.

Prinoth's Leitwolf marks the beginning of a new generation of snow groomers, equipped with state-of-the-art technology. The diesel engine fitted with an electronically controlled injection system reduces fuel consumption and exhaust emissions, thereby increasing the overall economy. The crawler tracks are made of steel and aluminum belts studded with

spikes to ensure excellent climbing and driving properties. Enhanced hydro pneumatic suspension with eight dampers improves the driving and working experience. Light trellis tubing withstands high levels of stress and strain. At the heart of the vehicle beats a MAN 320-kW diesel engine with superior torque output and low fuel consumption. The advanced hydro-pneumatic suspension reduces vibration for improved driving comfort. Together with these technical enhancements, the company's electronic control system ensures performance, safety and extra comfort for the driver.

"TTEControl's distributed electronics supports a high level of flexibility in our vehicles," states Martin Runggaldier, Head of Engineering at Prinoth. "As a result, we were able to optimize mechanical functions by combining them with electronic control. Furthermore, we could implement functions that would not have been possible with purely mechanical solutions." The highly developed control system of the vehicle has strong computation-

al capabilities and responds to all tasks immediately. The system contains three electronic control units, a drive control unit, a display, two keyboards, and a joystick. The joystick-hand control of the vehicle combines all functions of the front rake blade and the rear snow tiller. It controls the starting, stopping, raising, and lowering of the articulated snow tiller and adjusts the cutting and tilling angle as well as the side shifting of the rear snow tiller. It also monitors the horizontal and vertical float setting and checks the

operating times of the front windshield. A special toggle button allows correcting the minimum and maximum power of the winch in critical situations. The central color display views all gauges and is equipped with a changeover switch. All main commands are entered on the keyboards. The ergonomic joystick simplifies the blade and drives operations. Finally redundancy of the electronic components and computer diagnostics ensures maximum safety.

"Snow groomers are technically demanding vehi-

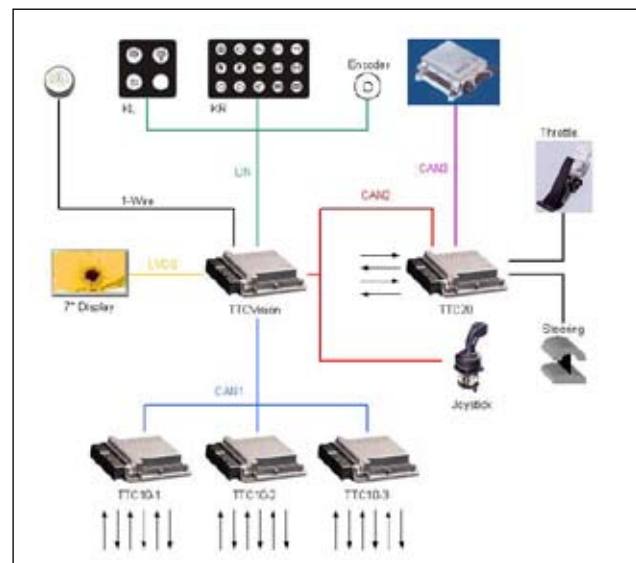


Fig. 2: The Leitwolf's three CAN networks

cles with very complex control functions. It was an interesting challenge for us to equip the Leitwolf with our systems and we are glad about the chance to prove our experience and know-how in the field of special off-highway vehicle electronics," states Marc Weisengruber, responsible for Business Development TTControl-TTtech Off-Highway.

Innovations in electronic control

The visualization unit Vision Plus controls the views of the cameras and displays the machine parameters. Integrating the camera vision system with the vehicle application in a single LCD display represents a significant benefit, reducing production costs and increasing operating safety. The HMI (human machine interface) has also been designed for use in vehicles and machines that run in harsh environments and is protected by aluminum housing. The HMI can be connected to both CAN and TTP (Time-Triggered Protocol) networks.

Three CAN networks connect three TTC10 controllers, one TTC20 controller, one TTCVision, a motor controller, and a CAN joystick. CAN1 connects the three TTC10 and the TTCVision, CAN2 connects the TTC20 and TTCVision and the joystick, and CAN3 connects the TTC20 and the motor control unit. The TTC 20 control unit is responsible for the driving system, by means of which the engine power can easily adapt to the operating conditions. The three TTC 10 control units manage the rear snow tiller, the front rake blade and the entire on-board in-

strumentation of the snow groomer.

All control units of this product family are specifically designed for use in the harsh environment of off-highway vehicles. They fulfill automotive requirements over the extended operating temperature range of -40 °C and up to +85 °C. The robust injection-molded aluminum housing protects against electromagnetic disturbance and mechanical stress and allows the mounting of the control boxes outside the cabin. The products are the first controllers worldwide suitable for commercial production

supporting both CAN and TTP. They can be used as stand-alone solutions or as part of a networked system and are well suited for safety-critical applications.

The vehicle benefits from the use of integrated electronics instead of conventional mechanics. The four compact control units are placed in a box behind the driver's seat. This protects them from changes in temperature and bad weather and allows the driver to view more of machine and surroundings through the greatly enlarged windshield. Electronic control systems open up new ways to implement mechatronic solutions. New functions can be realized by simply adapting the software. This guarantees a high degree of flexibility and extensibility. For example, a new traction control has been developed and tested for the vehicle without the need to change the mechanics. By this means, the climbing capabilities for bad snow conditions could be optimized. Other features can be integrated in the future by simply changing the software.

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Fig. 3: The Leitwolf snow groomer in action

Industrial PCs

Beckhoff (www.beckhoff.com) is releasing a generation of industrial PCs that can be connected to CAN via the company's fieldbus cards with 128 KiB NOVRAM. The C69xx control cabinet PCs and the CP72xx Control Panel PCs each feature two Ethernet interfaces with Ethernet higher-layer protocol. In combination with the Ethernet Mini PCI cards, the iPCs provide a third Ethernet port.

For wireless railway applications

MEN (www.men.de) has launched the F210 con-

troller board for railway applications with GSM/GPS/UART interface. The board provides an FPGA that enables further connectivity such as CAN or IBIS and requires just one slot of a Compact PCI bus card in a controller housing. It features a GSM-R controller (railway) and supports frequency classes EGSM 900 and GSM 1800 (850 and 1900 in North-America). An additional GPS controller on the controller board transmits current position data via mobile phone text messages. The GPS receiver supports the 12-channel GPS and AGPS technology and receives even fairly

weak signals, according to the company.

CANopen NMT master and slave

Sys Tec (www.systemec-electronic.com) provides the SysWorxx PLC controller with CANopen NMT manager and NMT slave functionality. The controller is IEC 61131-3 programmable and supports CiA 302 and CiA 305 (layer setting services) as well as the device profiles CiA 401 and CiA 405. The controller provides several digital and analog I/Os, an additional RS-232 and an Ethernet interface. Depending on the model, counters

and encoders are available, too.

Loop controller

Aris (www.stellantriebe.de) provides the PMR 3 loop controller with CANopen interface for positioning the company's actuators. The device provides a resolution of 12 bit (4096 steps) for setpoint values and 12 bit, respectively 10 bit for actual values. It runs on 0 V_{DC} to 10 V_{DC} (4 mA to 20 mA) at temperatures ranging from 0 °C to 70 °C. Interfaces include CAN, RS-232, and USB. An LC displays two lines with eight letters each of status, values and programming parameters. (mm)

Controller