

POWERLINK in mobile automation

High speed for mobile equipment



Photo © BSR

With each generation of mobile equipment more automated than the last, the traditional CAN bus can no longer handle the necessary volumes of data. Having proven themselves for years in a diverse range of manufacturing and processing applications, industrial Ethernet protocols like POWERLINK offer exactly the performance boost that the construction and agriculture industries are looking for.

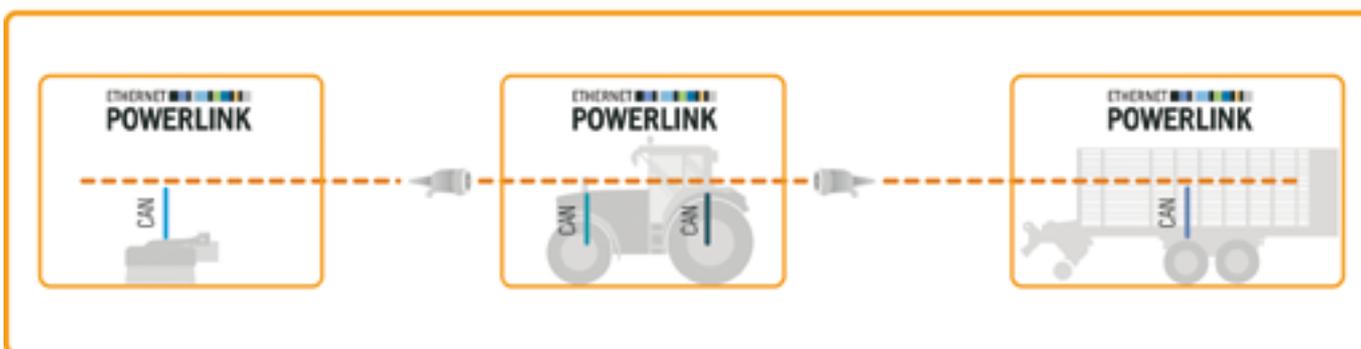
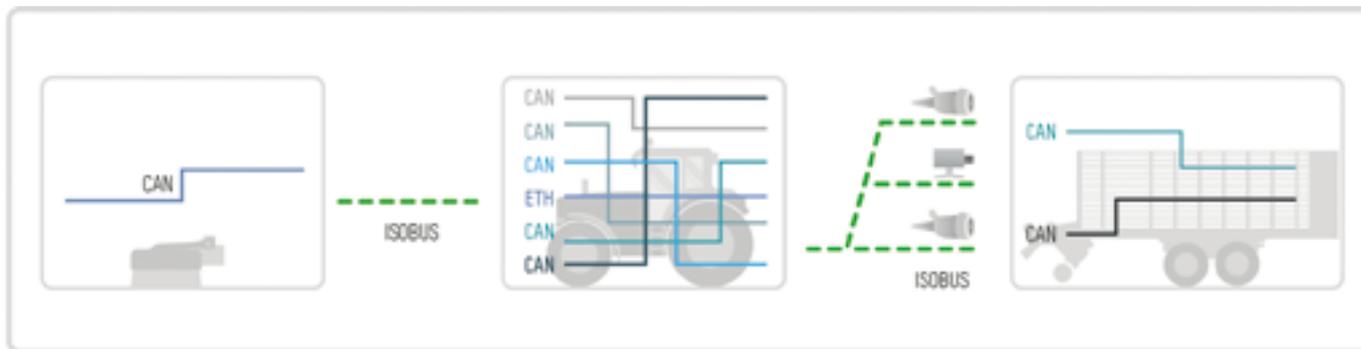


GPS navigation, rear view cameras, safety technology and countless fully-automated processes have all become standard features on today's high-tech mobile equipment and commercial vehicles – from combines and excavators to fire engines and multifunctional municipal vehicles. Having exceeded the maximum bandwidth of the conventional CAN bus, vehicles now rely on as many as ten parallel CAN networks to provide the necessary functionality.

More bandwidth

"With every network you add, you also add time and cost for engineering, maintenance and diagnostics," explains Stefan Taxer, B&R's product manager for mobile automation. And yet, there is still not enough performance or bandwidth for safety-critical applications. "Manufacturers have reached a point where the traditional bus system is standing in the way of progress." Mobile automation is looking for a new backbone bus system to serve as the basis for sustainable innovation.

"Industrial automation faced a similar dilemma around the turn of the millennium," notes Taxer. Since then, a high-performance solution has emerged as the clear winner: industrial Ethernet. It offers a larger bandwidth, is real-time capable and is based on the cost-effective Ethernet standard. "These benefits will make it successful in many areas of mobile automation as well," Taxer is convinced. The common Internet protocol TCP/IP is not an option, because it doesn't support deterministic communication.



With POWERLINK, you can transfer all the data for a mobile machine – or even a combination such as a tractor, mower and trailer – using a single cable.

The choice of a bus system is a long-term commitment, so manufacturers are looking for a solution that is open and future-proof. “That’s exactly what POWERLINK is designed for,” says Taxer. The protocol stack is published under the BSD license. The source code for master and slave implementations is readily available to anyone, and there are no licensing fees. POWERLINK’s user organization, the EPSG, offers any manufacturer the opportunity to join and help shape the future of the protocol.

POWERLINK based on CANopen

Implementing a new bus system can be a costly process, with new hardware to be purchased and a large portion of software to be rewritten. “Despite the huge leap in performance, switching to POWERLINK as the backbone bus is surprisingly easy,” explains Taxer. POWERLINK uses the CANopen object dictionary as well as CANopen profiles and communication mechanisms. Cyclic process data is exchanged via process data objects and parameter data via service data objects. POWERLINK and CAN work together perfectly.

Communicate faster – 100 Mbit/s

Like CANopen, POWERLINK also offers direct cross-communication. All CANopen applications and device profiles can be directly implemented in a POWERLINK environment – as far as the application is

concerned, there is no difference between the two protocols. The difference in speed, however, is considerable: POWERLINK has a transfer rate of 100 Mbit/s. In cases where even more bandwidth is needed, it’s no problem to switch to Gigabit Ethernet.

“Today’s mobile equipment can have up to 3,000 meters of network cable in as many as 10 networks,” says Taxer. This results not only in high costs for installation and maintenance, but also increases susceptibility to errors.

One cable for everything

With POWERLINK, you can transfer all the data for a mobile machine – or even a combination such as a tractor, mower and trailer – using a single cable. In addition to real-time process data, the network also carries HMI data, safety data and the video signal from the rear view camera. POWERLINK’s multimaster capability allows self-driving equipment to switch between controlling itself and being controlled from a tow vehicle – without having to make any configurations or restart the system.

POWERLINK networks offer complete freedom of topology. “Star, tree, bus or ring structures – or combinations thereof – are all possible without requiring any network configurations,” explains



Taxer. The resulting modularity allows you to add or remove network segments during operation. Particularly when it comes to modular machine design, POWERLINK offers maximum flexibility paired with optimum usability.

More complex automation solutions have conventionally required multiple networks and multiple controllers, each with its own software. Of course, this all has to be coordinated and maintained. With the high data transfer rates and real-time capability of POWERLINK, all you need is one controller for one application. Data from sensors and actuators is sent to the controller in real time, where it is processed and returned as required. Centralized and decentralized control architectures are equally possible.

High machine availability

"Compared to other Ethernet-based fieldbuses, the cost of implementing POWERLINK is very low," says Taxer. There are no license fees or special hardware, and – rather than come at the cost of quality – the savings are actually accompanied by an increase in machine availability. The high bandwidth allows you to do things like implement detailed diagnostics or perform software updates quickly and reliably over the network. Since POWERLINK uses a single-frame protocol, it is virtually immune to EMC disturbances.

Safety included

Since mobile equipment is also subject to the EU machinery directive, it often requires its own safety application. "openSAFETY is perfect for this," says Taxer. The open source safety protocol can be implemented in conjunction with POWERLINK and doesn't require a network of its own. Safety-related data is transmitted over the POWERLINK network independently of other traffic. Pre-certification up to SIL 3 / PL e makes implementing openSAFETY especially fast and uncomplicated. ←



Stefan Taxer

Product Manager - Mobile Automation

"POWERLINK makes it possible to implement modern automation solutions on the basis of CAN technology. The protocol offers plenty of bandwidth for video, remote HMI, real-time processing and safety."