

Wheelift heavy transporter: 'power lifter' and precision instrument in one unit

## PC-based control handles the heaviest loads

Global manufacturers in the energy, chemical, construction and aerospace fields have to manage and efficiently move continually larger and heavier products to remain competitive. This requires high-performance transport vehicles. Wheelift heavy transporters from Doerfer Companies (TDS Automation) based in Waverly, Iowa, USA, are able to handle payloads of more than 500 tons with maximum precision and are ideal for such applications.



Wheelift heavy capacity transporters cover the 50 to 500+ ton payload range.

Wheelift is a dynamic technology and is a trademarked name used to describe heavy capacity, wheeled transporters that tackle the Herculean 50 to 500+ ton payload range. Major Wheelift applications meet the heaviest lifting requirements for manufacturers of very heavy products such as transformers, turbine generators, mining machinery, nuclear processes and shipbuilding.

### A weighty challenge

"To stay competitive, Doerfer must provide absolute reliability at all times. Any operational failure is very difficult to recover from due to the extreme loads involved. In addition, manufacturers are making larger modular components that join during final assembly. These demanding applications need a tight, reliable process for safely moving heavy, high value products," says Roy Linden, Wheelift Account Manager.

Industrial applications for Wheelift heavy transporters are quite varied, and the transporters truly outshine the alternatives: while Wheelift transporters' size and capacities are custom-designed to meet individual applications. Engineers recently designed three 57 ton-rated transporters to operate both singularly and in tandem. Wheelift operators simply position the flexible transporter(s) beneath a load, raise the deck to lift it, and then transport it wherever it needs to go and simply set it down.

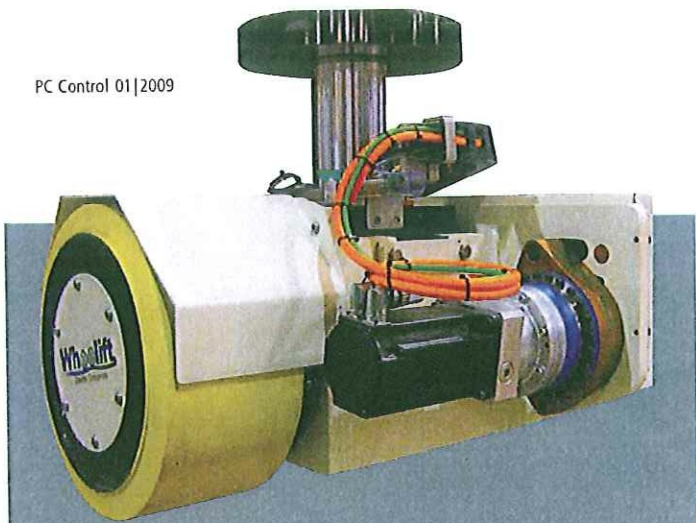
The earliest designs of Wheelift transporters utilized black box PCs that were programmed in an assembly language. "Unfortunately, only a handful of experts across the United States could maintain and update the equipment. That became a compelling reason to shift toward an open, PC-based platform," Mark Lavallee, a Doerfer Controls Design Manager said. A critical requirement of the new controls platform was its ability to handle the existing hydraulic system. The new sys-

tem required enhancements including greater reliability and increased accuracy and resolution for the tightly integrated hydraulic and electrical servo systems. The Wheelift team also needed an IEC 61131-3 programming environment to handle the complex software of Wheelift's Synchrosteer® control. "TwinCAT PLC software from Beckhoff gave us that foundation," Ron Howell, Electrical Engineer at Doerfer Companies said.

"The compact nature of the Beckhoff control solution was critical for our new Wheelift transporters," Craig Schmeiser, Wheelift's Program Manager said. "We are always quite conscious of available cabinet space due to the low profile requirements for heavy transporters. We were able to assemble a highly efficient package with a CP62xx Panel PC with 12-inch display, AX2000 Servo Drives and AM3000 Servomotors along with various Bus Terminals. The streamlined way the controls fit together helped us design a system that is as compact as possible," Schmeiser said.

### High-speed Motion Control via EtherCAT

Bus Terminals, networked with a BK1120 EtherCAT Bus Coupler, are used as the I/O system for communication within each Wheelift transporter. "The performance of EtherCAT is impressive and the equipment is very easy to integrate since it is based on standard Ethernet technologies," Howell said. "EtherCAT can expertly handle high-speed Motion Control and work in parallel with many other fieldbus networks. Depending on the Wheelift transporter, 8 to 24 servo axes are individually controlled using a single CP62xx." He added, "Synchronous, coordinated motion would have been very difficult to accomplish on this scale using traditional PLC systems. Our cycle times for critical motion functions are 1 ms or less."



### Wheelift-Uniload® module with Beckhoff motor

To tackle the heaviest tasks, Wheelift transporters featuring the Uniload® wheel module design incorporate the following performance features:

- | Equalized 3-point fluid suspension to minimize peak ground pressure loading values
- | Omni-directional steering that provides 100 % movement flexibility
- | Very low deck profile that provides increased usability and safety throughout a manufacturing complex
- | Precision move capability (steps as small as 25 µm) to facilitate load placement and provide sub-assembly engagements that were previously not possible
- | Built-in lift for self-loading that eliminates additional expense for related machinery and work assignments

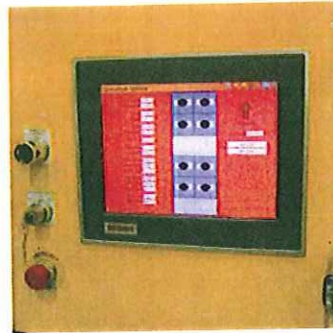
### Power monitoring made simple

The Wheelift heavy transporter is a self-contained system with an on-board engine powering a 480 Volt, 3-phase generator which supplies power for the entire system. The KL3403 three-phase power measurement terminal gathers a wealth of data for monitoring Wheelift power consumption, which helps prevent potential problems before they arise. A single KL3403 terminal allows the Wheelift team to monitor the power without requiring any converter units. "With large, clunky black boxes, I wouldn't have even been able to monitor power in the Wheelift. With a half inch-wide KL3403 I/O terminal, I can easily," Howell said. Where possible, Wheelift also uses Beckhoff high density KM I/O modules (16-channel) for even greater space savings in electrical cabinets.

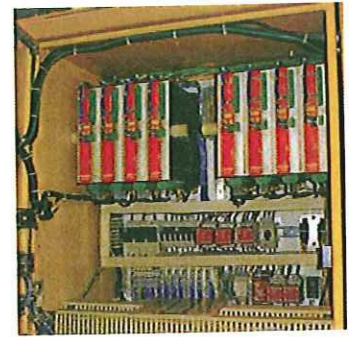
### Powerful performance with user-friendly technology

An Ethernet publisher-subscriber methodology is used for high-speed communication between Wheelift heavy transporters. For example, if three Wheelift transporters are operating in tandem (tied together, each with their own processor) one vehicle can act as a leader with the two others as followers. The master transporter sends commands to the follower transporters and the followers respond to relay the system status. "The real-time Ethernet capabilities allowed us to tightly synchronize the vehicles for high-speed operation," claimed John Pullen, a Doerfer Sr. Staff Designer.

"The processing power of the Beckhoff Panel PC is more than up to the task of the multi axis Wheelift systems," Lavallee said. "Even with all the deterministic motion, we're still only using 27 to 30 percent of the total PC processing power. The open nature of the system also helps add new features and functionality without any problem." Our increase in system performance did not come at an



The Wheelift team decided to use the Beckhoff CP62xx Panel PC as an 'all-in-one' control and display solution for all HMI, automation and control functions



Wheelift heavy transporters feature a complete Beckhoff control system equipped with TwinCAT PLC software, EtherCAT and Bus Terminal I/Os, AX2000 series servo drives and AM3000 servo motors along with the CP62xx Panel PC as a centralized controller.

increased cost," Schmeiser said. "On the contrary, Beckhoff controls were up to 30 percent less expensive than the traditional PLC architectures. Of course, the decision to move to Beckhoff technology was primarily performance-based and the cost reductions were secondary to our decision, but a welcomed benefit."

"TwinCAT software has allowed our programmers the ability to include some very valuable and meaningful data back to the user in formats that are easily understood," Linden added. "Also, end user feedback for the new Wheelift systems has been very positive with supportive comments regarding the new system's ease of use, reliability and maintainability."

"We plan to use a complete Beckhoff control system on all future Wheelift heavy transporters," Schmeiser concluded. Looking toward the future, the Wheelift engineering team is evaluating the AX5000 series EtherCAT Servo Drives for implementation in their heavy transporter systems. "With dual-axis drive variants, we feel like this would further improve our cabinet space savings," Lavallee said.

Wheelift heavy transporters  
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