Pilot-less, remote-controlled suction dredger uses PC Control

The automation technology aboard the suction dredger ship, "Werthersechte" was recently modernized to improve cost-effectiveness while reducing wear-and-tear and energy consumption. Pilot-less automatic operation of the suction dredger was achieved with the DredgerControl system from German company Team GmbH, based on Beckhoff Bus Terminals and TwinCAT software. The monitoring system enables all dredger components to be visualized and controlled either from the dredger or from land.

The suction dredger "Werthersechte" can be controlled remotely via a mobile hand terminal.

Suction dredgers extract sand and gravel via a suction tube and deliver the materials ashore using a tube assembly. With a suction pressure of approx. - 0.7 bar (vacuum) a delivery volume of 300-400 tons per hour is standard. The vacuum control is designed to precisely guide the suction tube head to the material. The flow of material should be smooth and without large fluctuations in order to achieve a uniform operating point for sand pumps. Any events that interfere with the process, such as cave-ins or obstructions, are dealt with immediately. The control system from Team GmbH monitors all main process parameters such as vacuum, pressure, flow velocity, power and speed of the different components. The DredgerNaut measuring and visualization system is used for optimizing extraction from sand and gravel pits.

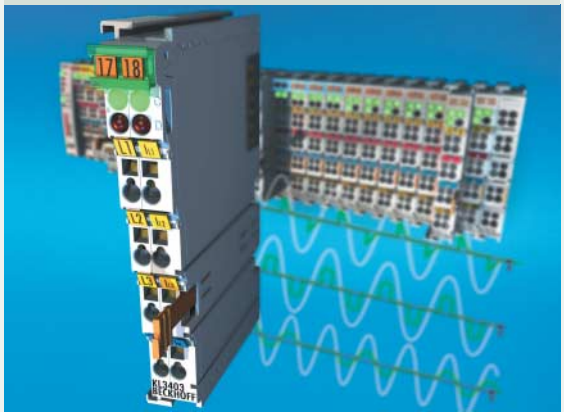
High-tech aboard

The suction dredger is equipped with DGPS (Differential Global Positioning System) receivers, sonic sensors, as well as angle and position sensors for obtaining required measurement readings. The monitoring system receives the required digital and analog process signals from the DredgerControl system via the ADS interface of the TwinCAT system. The functions offered by the control system include the following:

- Positioning of the dredger in the sand/gravel pit via a high-precision DGPS receiver system;
- visualization of the dredger via topographic maps and in 2D and 3D;
- data management in different terrain models;
- apart from the terrain models generated from actual and target depth values, the system also manages maximum depths and interference or transition layers and processes them online;
- actual depths are continuously updated;
- maps and digital terrain models are updated every 20 seconds.

The visualization of the warps and the position of the dredger on the gravel pit enable the dredger to be moved safely via remote control.

Working current monitoring via KL3403 power terminal



The suction dredger is positioned on the lake via four ropes. The position of the suction dredger has to be changed depending on the extraction depth. The following parameters have to be considered for the remote control:

- What is the position of the dredger located on the gravel pit?
- At what angle are the ropes attached to the dredger?
- What movements are possible with a given anchor position?
- Are the ropes taut or slack?
- Is the rope tension influenced by wind?

The working current of the winches is monitored via the 3-phase KL3403 power terminals. All four winches can be operated simultaneously via direction keys. The function is automatically deactivated if the winch current at one or several winches exceeds a preset value. The monitoring function for the winch working current is integrated in the PC Control system and prevents overloading of the drives and triggering of the motor protection switches. This technology enables "old" winches with worm gear to be used without modification.

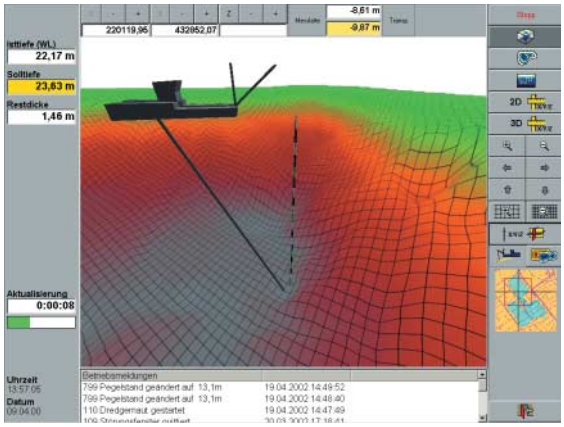
Remote control from solid ground

Two land-based stations handle the remote control of the dredger. A comprehensive operation protocol indicates the state of the suction dredger and the land-based units connected to it. The land stations are connected to the telephone network, providing fast and simple access to the suction dredger system for the DredgerTec team and the head office. Staff can remotely service and diagnose the system from their workstation. This enables short response times with extremely low costs.

Communication between the individual DredgerTec systems takes place via the TwinCAT ADS interface. All connected systems access the same master data. The visualization is based on the Visual Studio.Net development environment.

Depending on the application, the visualization is done on an Industrial PC, Panel PC or an additional PDA hand terminal. Communication with the TwinCAT system of the suction dredger takes place via TCP/IP and copper, optical fiber or wireless LAN connections.

Each unit of the suction dredger can be controlled via the visualization system on the dredger or from land.



Production increase exceeds expectations

"The chance we took with the application of a new technology has paid off," Bernhard Wittenberg from Team GmbH said. "During practical application, our control system has exceeded the original expectations. Dredger production has increased by around 22 percent. In more than two years of operation, we had no unscheduled downtime caused by the control system. One big advantage of the Beckhoff Bus Terminal I/O system is optimum expandability. Downtime for setting up extensions, such as commissioning of the recently installed booster station, is extremely short. Apart from inspections, the new solution enables pilot-less operation of the suction dredger via remote control from the shore. Since the prototype system was commissioned in Werth, Germany in 2002, six additional suction dredgers have been equipped with the DredgerControl system.

→ Team GmbH **www.dredgertec.de**