



PSI Technics Replaces Discontinued Trimble ICS5000L System



Bridge Crane after modernization

24.02.2012 09:37:14 - Hanson Pipe & Precast is one of the world's largest concrete pipe manufacturers, and the largest manufacturer of concrete products in North America. It is part of Lehigh Hanson, Inc., a member of the Heidelberg Cement Group and one of North America's largest suppliers of heavy building materials to the construction industry. In March 2011, the company's St. Martinville, Louisiana facility decided to integrate PSI Technics' state-of-the-art Positioning Solution System into their fully automated crane system as part of the modernization of their existing facilities.

The previously installed positioning system, the ICS5000L incl. Advanced Skew Control (ASC) which was discontinued by the manufacturer Trimble, was replaced by PSI Technics' Positioning Solution System with Advanced Skew Control that provides

single-axis control for the trolley traversing machinery. Due to the high environmental temperatures of more than 140°F (+60°C), Hanson Pipe & Precast decided to add PSI Technics' TPCC Thermo Protection Cooling Case to protect their optical distance meters from the production plant's environmental conditions.

Long-time Hanson Pipe & Precast supplier, Hawkeye Pederschab, based in Mediapolis, IA, took a lead role in the project to ensure its success.

Up to now, Hanson Pipe & Precast had used an optical based positioning system for bridge crane positioning. Like many other companies, Hanson Pipe & Precast was faced with the decision to completely renew their crane automation system or to modernize the existing installation, after the manufacturer had discontinued its factory automation production line in 2005. Due to its modular design, PSI Technics' Positioning Solution System was the only system that provided for a seamless integration into the company's existing facilities. The Positioning Solution System delivers innovative features and a high availability to Hanson Pipe & Precast.

During the modernization process, PSI Technics faced several challenges. One of the biggest challenges consisted of the handling of varying loads, because the production process and the manufacturing and curing process of the concrete pipes played a vital role. The weight of the freshly poured concrete pipes that are stored for curing differs from the weight of the retrieved cured pipes. Therefore, precise positioning with millimeter accuracy as well as oscillation-free acceleration, deceleration and positioning while handling heavily varying loads were of utmost importance.

The Positioning Solution System Opens Up New Possibilities

The Positioning Solution System is a modular positioning control system for bridge cranes, stacker cranes, shuttle cars and other industrial vehicles. When the System was developed, PSI focused on creating a modular system. A modular system has the added benefit that standard hardware components are easily replaceable when used with intelligent positioning control software based on a Linux real-time operating system. Users can choose the ideal hardware components in consultation with PSI Technics. The Positioning Solution System control unit contains the system's intelligent control algorithms and software.

In addition to featuring state-of-the-art interfaces, the System is compatible with old TCS4000, ICS5000L and ASC products from Trimble. This means that modernizing an existing installation may simply involve replacing the hardware and software components of existing positioning systems. In this way, no changes to the PLC structure and no costly reprogramming of the control environment are required.

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AdChoices

What is Advanced Skew Control?

Advanced Skew Control (ASC) synchronizes two independent drives of a particular installation and controls those drives in relation to distance measurements. This involves maintaining a well-synchronized motor operation, speed and rotation angle of the individual drives, irrespective of changes to reference variables and interferences from the machine or installation. Advanced Skew Control keeps the skewing of a crane bridge that is equipped with two motor drives to a minimum.

Technical Description and Implementation

The crane's traveling axis was previously equipped with three Trimble ICS5000L control units and Trimble ASC. The goal was to modernize the system while keeping costs for technical equipment to a minimum. To guarantee a fast and easy commissioning of the system the required technical data was collected during a preceding plant inspection, called a site audit. During the inspection, PSI Technics noticed that the customer operated the existing ICS5000L positioning system in an environment where temperatures exceeded 140°F (+60°C). Consequently, PSI Technics' Thermo Protection Cooling Case (TPCC) for the protection of temperature-sensitive sensors was the perfect addition to Hanson Pipe's installation and ensures maximum sensor life.

The technical details of the bridge crane are listed below.

Bridge Crane – Technical Data

- Span: approximately 98 ft (30 m)
- Height: approximately 16 ft (5m)
- Maximum traveling speed: 5.18 ft/s (1578 mm/s)
- Maximum acceleration: 0.76 ft/s² (232 mm/s²)
- Maximum travel distance: approximately 196.8 ft (60 m)
- Maximum load capacity: approximately 32 tons
- Dead weight: 50 tons
- Drives: 2
- Frequency inverters: 2

Trolley – Technical Data

- Maximum traveling speed: 2.10 ft/s (640 mm/s)
- Maximum acceleration: 0.80 ft/s² (245 mm/s²)
- Maximum travel distance: approximately 82 ft (25 m)
- Maximum load capacity: approximately 25 tons
- Drives: 1
- Frequency inverters: 1

Old Positioning System – Technical Data

Bridge Crane:

Communication protocol:

- RS232, ASCII protocol for ICS5000L, 9600 baud, 8 data bits, 1 stop bit, no parity Frequency inverter control:
- Voltage: 0-10V
- Direction change through forward/reverse contact

Trolley:

Communication protocol:

- RS232, ASCII protocol for ICS5000L, 19200 baud, 8 data bits, 1 stop bit, no parity Frequency inverter control:
- Voltage: 0-10V
- Direction change through forward/reverse contact

System Setup Prior to Modernization

The original system setup included two ICS5000L units that were connected to an advanced skew control. The skew control was connected to the PLC via a communications line and synchronized the movement of the crane bridge after a travel command was issued. A single ICS5000L directly communicated with the crane controls and controlled the trolley movements. The ICS5000L cables were used for serial communication and for the transmission of set points for the frequency converters, digital brake and safety signals as well as forward/reverse signals.

System Setup After Modernization

During the modernization, the cabling requirements were considerably reduced. Laser distance meters provide positioning feedback to the System. A single Positioning Solution System, which is expandable to support three axes, was able to replace three Trimble ICS units in one, consolidated hardware control unit. The Positioning Solution System control unit receives distance values from the laser distance meters via its SSI interface and merely requires a signal line to the laser distance meters. A single cable per laser distance meter is sufficient. The cable acts both as a power supply and transmits the SSI signals. After the modernization the communication signals and the analog signals are routed from the control cabinet to the corresponding modules of the System control unit.

Laser distance meters provide positioning feedback to PSI Technics' FLP6000ASC Advanced Skew Control software. Another laser distance meter provides feedback for trolley positioning with the FLP6000MC software. Thus, the original positioning system and all features were completely replaced by the modular Positioning Solution System hardware configuration. The control unit provides centralized control for all bridge crane positioning tasks.

In addition, PSI Technics' FLP6000ASC software offers added benefits. Traditional skew control systems operate according to a master-subordinate principle during positioning. This means that the movement of the subordinate axis always follows the movement of the primary or master axis. If, for example, the primary axis slows down due to a fault, the movement of the subordinate axis will be adapted automatically, but the underlying fault will neither be detected nor eliminated.

PSI Technics' FLP6000ASC software, however, uses two independent single-axis control systems. Each controls a single motor drive according to a master-master principle. The innovative and intelligent software recognizes and immediately compensates for any interference. If, for example, an axis decelerates due to increased resistance, the system immediately responds and accelerates the axis and the synchronized operation of both axes will be restored instantly. The Advanced Skew Control software not only ensures a synchronized movement of both axes, it also eliminates any manually introduced skewing by squaring the crane bridge before a movement is initiated. Whenever skewing occurs, the bridge can either be squared prior to a movement or while the bridge crane is moving. For particular applications, deliberate skewing can be introduced. Example: A bridge crane lowers steel plates onto a production line that is positioned diagonally to the crane path. In this case, skewing can be introduced to ensure that the crane is moving parallel to the production line and lowers the plates at the correct angle. This can be defined in the vehicle's motion path profile.

TPCC Integration

The high temperatures at the Hanson Pipe & Precast site constituted another challenge. The wet concrete pipes are steam-treated at the plant while curing. As a result, environmental temperatures in the production hall exceed 140°F (+60°C) – a significant disadvantage, since it not only shortens the life-span of laser sensors, but it can also lead to higher maintenance costs. To eliminate the risk of malfunctioning sensors in the future, the sensors will be protected by PSI Technics Thermo Protection Cooling Case (TPCC). This innovative cooling case is made of lightweight composite material that provides excellent insulation and cooling properties. Since the TPCC was specifically designed for an easy integration into existing industrial facilities the mounting and electrical installation at the crane went smoothly. Another big advantage for the customer was that the TPCC's 24 V cooling system is based on thermo-electric processes, so no additional modification of the system was required.

"The PSI Technics team members are all highly professional and their expertise in every phase of the implementation: pre-sale planning, pre-installation site audit, installation and commissioning and post-sale service allowed the conversion to occur seamlessly. The PSI Technics solution offered many advanced improvements from the old system: Off-the-shelf lasers; cooling options to extend the life of the lasers; Ethernet-based communication for remote assistance; data logging, graphing, and backup features", said Ben Schmidgall, Chief Automation Engineer for Hawkeye Pedershaab, who worked closely with PSI Technics throughout the project.

Conclusion

PSI Technics' Positioning Solution System and the TPCC provide Hanson Pipe & Precast with a durable and robust solution for their internal logistics processes. The modernization of the system for three axes with FLP6000ASC software and the integration for the TPCC were completed in under a week – including the preceding plant inspection. Thanks to its modular design the Positioning Solution System delivers a fast, efficient and flexible solution.

More importantly, Hanson Pipe & Precast not only benefits from precise positioning, but also from reduced maintenance costs and an increased life-span of their facilities.

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