100 µs on CNC controllers

NanJing Washing CNC has been developing CNC controllers for 10 years. Last year, the company sold 8,000 CNC controllers – making it one of the top three suppliers in China. With its newest CNC controller, Washing CNC used POWERLINK to reduce the cycle time to an astonishing 100 µs.

The POWERLINK slave station based on an Xilinx FPGA.

Customer requirements are constantly evolving, and the number of competitors in the field of automated control systems is growing steadily. At the same time, expectations for ever greater precision, processing speed and functionality demand more and more performance from the bus system. Since 2010, Washing CNC has been working on a new CNC controller that delivers this performance. When developing this cutting-edge project, requirements included the use of non-proprietary technology as well as staying within a competitive budget.

Against this backdrop, POWERLINK – an open real-time communication protocol – became a key element in Washing CNC's solution. The technology behind this Ethernet standard provides uncompromising performance and real-time capabilities based on the established global standard as defined by IEEE 802.3. Using POWERLINK not only reduced overall wiring – and the associated costs – but also opened up new machine design possibilities.

A strategic choice

For the developers, it was especially important to select the platform best-suited to their needs. Together with the development team, CEO Zhelu Li, for whom this long-term project is of great importance, decided to base the new high-performance CNC controller on POWERLINK. Developing a controller such as this requires not only extensive technical expertise, but also broad experience in software development. The engineers at Washing CNC have gathered this experience through the development of FPGA- and ARM-based hardware platforms as well as software based on Linux and Windows CE.

CNC controller with cycle times <100 µs

Zhelu Li tasked his development team with building a CNC controller that was up to international standards and able to handle large volumes of process data while also achieving cycle times under 100 µs. This was the type of technology Washing CNC would need in order to maintain its market leadership through the next 5 to 10 years.

POWERLINK can run on a wide range of platforms, including ARM, Power PC, Intel x86 and FPGA. The WA730/740 series that Washing CNC was planning include high-end CNC controllers with exacting demands on real-time behavior.

ETHERNET ■■ ■ ■■■■■ ■
POWERLINK

As a successor to classic fieldbus technology, POWERLINK provides uncompromising performance and real-time capabilities based on the established global standard, Ethernet. A transmission speed of 100 Mbit/s and a synchronization accuracy of < 100 ns allow even the most demanding tasks in the areas of control engineering, robotics, CNC and motion control to be combined in a single network.

The new WA730/740 series were first introduced in 2013 at the Industrial Automation Show (IAS).

An FPGA is the optimal platform for this type of task. The decision was made in favor of an FPGA chip from Xilinx, which offers clock synchronization with jitter values between 20 and 60 ns. This chip provides the hardware basis for integrating POWERLINK into the new high-performance CNC controller.

Complete solution platform

The open-source POWERLINK project includes not only the source code for the POWERLINK stack, but also a complete system for developing the network interface and configuring network communication. It offers developers numerous tools for developing reference circuits, coding and documentation as well as testing tools such as the XDD checker and the openCONFORMANCE tool. The openCONFIGURATOR tool for network configuration can be used as a plug-in for engineering tools. The open-source diagnostic tool Wireshark can be used to analyze the system and simplify the development process.

Peak performance

Washing CNC first introduced the new WA730/740 series in 2013 at the Industrial Automation Show (IAS). Washing CNC and its POWERLINK-enabled products impressed visitors with 100 µs response times.

POWERLINK has earned its position at the heart of Washing CNC's solutions, and the company has plans to continue developing and improving its POWERLINK-based product series to meet the specific needs of its customers. ←

Jiang Chen, **Director of Research & Development, Washing CNC**

"The development team was tasked with building a high-end CNC controller up to international standards that can handle large volumes of process data while also achieving cycle times under 100 µs. This is the type of technology we need in order to maintain our market leadership through the next 5 to 10 years."