KOLLMORGEN

Because Motion Matters™

Reduce Costs and Improve Performance with Digital Buses

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What are some of the advantages of using a digital bus for motion control in machine and robot builder applications?

Machine design using a digital network has several advantages over discrete connections where +/-10V servo signals and individual digital and analog I/Os signals are wired to a central controller.

Digital networks provide a high level of system visibility and often support device troubleshooting and diagnostics from the network master. Instead of a single Amplifier Fault signal wired through a single digital I/O point, fault information is transmitted via the network where device specific data can reported through a central software tool. In SynqNet™, for example, the same Node Status function can be used to return device specific error codes to significantly reduce troubleshooting time and increase software portability.

Modern digital networks also help reduce cost by reducing wiring and simplifying connections between the system controller and network devices. Networks using widely available 10/100/1000BaseT technology can replace dozens of wires per motor with a standard CAT6 cable. Checksum registers and watchdog timers allow the software to constantly monitor device health and cable integrity.

Fast motion buses with low jitter and fast update rates allow more sophisticated controls for complex mechanical systems, while still taking advantages of the reduced wiring and diagnostics. Slower networks do not have the bandwidth to support more complex controls requirements for gantries and robotics which may require cross-coupling or MIMO control.

Fast digital motion buses can reduce cost of ownership through the network-wide diagnostics as well as upgrade and maintenance. SynqNet, for example, supports firmware download to remote nodes and configuration for devices.

What are the main challenges?

Initial machine integration using digital buses can be more complex than traditional discrete wiring. Engineers can't connect a scope to a discrete signal to troubleshoot. Integration and validation between control software and various network devices generally becomes the responsibility of the machine builder.

Some motion buses require a significant amount of network and packet configuration to setup up the network and optimize performance. This can result in long evaluation and validation cycles.

Closely related to the integration, device interoperability is often an issue with motion buses. Network implementation may vary. Different networks have different levels of feature validation and device interoperability testing. This can lead to delays and expense as differences may not be evident when selecting two devices that supposedly adhere to the same spec. This is one of the key reasons that Kollmorgen maintains a SynqNet Interoperability Lab to continually tests combinations of all devices.

Getting support for network problems and addition of new features can be a significant issue for motion buses where the supplier does not control the spec. If there is an issue in how two devices interpret a third party or independently maintained spec, who can resolve the issue?

Does digital control need to be supplemented with hard-wired control for safety, high speed or other reasons?

Well designed motion networks use slave logic to solve any high-speed issue such as position capture or for synchronization. Real-time network communication and clock synchronization between nodes allow for high-speed coordination between distributed devices. SynqNet, for example, supports Position Capture and Position Triggered Output across network nodes with latency of <50nsec, accurate to +/-1 count.

Redundant hard-wired control for electrical safety is important for many systems. However, digital networks increasingly integrate safety features such as redundant communication channels to prevent network shutdown in the case of hardware or cable failure. Some digital networks also support functional safety over the same wire.

What are the main factors that keep some machine and robot builders from upgrading from hard-wiring to a digital bus?

Legacy designs and unique devices can keep some machine and robot builders from upgrading to a digital bus. Particularly when "in-house" hardware or software is involved, it can be difficult to upgrade to a digital bus.

Fear about the complexity and uncertainty of implementing digital networks can keep controls engineers from upgrading.

Incomplete or limited feature sets, performance limitations, and lack of available devices may cause builders to avoid digital networks.

Application Summary

Eastman Machine Company, a leading cutting machine manufacturer, needed to reevaluate their current system to determine the best solution for their next generation machines. Eastman needed to determine the most cost effective way to increase their machine's performance and reliability while helping minimize the amount of time and money spent on troubleshooting machines in the field.

Robotic System Integration (RSI), a value-added reseller of PC-based networked motion control systems, partnered with Eastman and suggested a solution at the network level using a digital motion network for machine control.

Previous machines were analog systems that required a large amount of cabling. Each machine had 14-20 different types of cables such as power cables, serial cables for controller I/O, and custom cables for discreet I/O. Since the analog motion controller and amplifiers were installed in an enclosed control box outside the machine, over 1000 feet of cable was required to accommodate the long cable runs between the control box and the machine.

Eastman wanted to reduce the amount of cables required for their machine, thus reducing potential cable failures in the field. Eastman chose SynqNet, an all digital motion network specifically designed for high performance motion applications. By transitioning to an all-digital network and taking advantage of its large data bandwidth, Eastman can now perform all system level control over SynqNet and use one network for supporting both motion control and I/O. SynqNet also gave Eastman the flexibility of creating

a motion network with centralized control and distributed hardware, which allowed them to place discrete I/O modules in more convenient locations for shorter cable runs. As a result, Eastman was able to reduce the total length of cable used by 80%.

ABOUT KOLLMORGEN

Kollmorgen is a leading provider of motion systems and components for machine builders around the globe, with over 70 years of motion control design and application expertise.

Through world-class knowledge in motion, industry-leading quality and deep expertise in linking and integrating standard and custom products, Kollmorgen delivers breakthrough solutions unmatched in performance, reliability and ease-of-use, giving machine builders an irrefutable marketplace advantage.

For more information visit www.kollmorgen.com, email support@kollmorgen.com or call 1-540-633-3545.