

Advancing industrial printing with TSN

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Developers of printing machines are facing particularly fast-paced and dynamic market conditions. Harnessing the true potential of smart, automated industrial operations is crucial to meeting ever more ambitious customers' needs and staying ahead of the competition. As fractions of a second can make a significant difference within advanced printing machines, cutting-edge motion control becomes paramount.

Tom Burke, Global Strategic Advisor at the CC-Link Partner Association (CLPA), looks at how Time-Sensitive Networking (TSN) can help achieve seamless synchronization, accuracy, and precision within complex, autonomous printing systems.

In many sectors, from publishing to pharmaceutical manufacturing, printing and stamping operations rely on machines that can quickly and reliably add high-quality designs and text with excellent resolution. To this end, the equipment must effectively offer precise positioning capabilities, correctly handle products and have all its axes moving in sync.

State-of-the-art motion control is therefore at the core of such units and their activities. Even more, as printing applications demand higher speed, greater resolutions and accuracies as well as lower tolerances, the need for next-level motion control solutions is evident.

Besides, as Industry 4.0 frameworks become a must to remain competitive, printing machine users are asking for solutions that can communicate with other machines on the shop floor as well as higher enterprise-level systems to support smarter operations. Ultimately, to meet these demands, OEMs need to create highly interoperable setups that are equipped to offer this level of convergence. In this

regard, the selected industrial automation components must be able to leverage a high-performance network technology.

Addressing the needs of competitive industrial printing

Traditionally, standard Ethernet has had limitations in meeting the stringent requirements of motion control, necessitating the setup of isolated networks to reduce latency, avoiding jitter and delay. The advent of Time Sensitive Networking (TSN) is providing a breakthrough solution. This technology, defined by IEEE 802.1 standards, is capable of establishing accurate, distributed time synchronization across multiple axes and network nodes.

TSN also enables the prioritization of urgent, time-sensitive traffic, while reserving cycle time for regular control data packets. This ensures deterministic performance even with large volumes of non-transient traffic, eliminating the need for specialized communication infrastructures for motion control. As a result, TSN can support the seamless integration of various message types from both the information technology (IT) and operational technology (OT) domains, in line with smart manufacturing strategies.

A leading network solution that embraces this technology is CC-Link IE TSN, the first open industrial Ethernet with TSN functions and gigabit bandwidth. It offers a cycle time of 31.25 μ s and can synchronize up to 256 axes with accuracies in the order of $\pm 1\mu$ s, therefore helping machine builders and end users with ambitious motion control systems for printing applications.

Case study: TSN advances industrial printing operations

A leading OEM of industrial printing and stamping machines wanted to develop an innovative, highly competitive solution to address its customers' needs for increased speed, accuracy and repeatable quality. To deliver a such machine, the company invested in industrial automation technologies compatible with CC-Link IE TSN, namely PLCs and servo drives.

In particular, the resulting machine could combine high-precision screen printing and hot stamping operations by being able to accommodate 90 axes. Through CC-Link IE TSN, these could all be synchronized with limited tolerances to deliver the high level of accuracy that customers would require. As a result, the setup offers a highly integrated and versatile solution that maximizes productivity, cost-effectiveness, flexibility, print quality as well as scalability.

Extremely happy with the capabilities of CC-Link IE TSN compatible devices, the OEM is now using them to upgrade its printing machine portfolio, driving its customers as well as its own competitiveness.

Image captions:



Image 1: Time-Sensitive Networking (TSN) can help developers of printing machines achieve seamless synchronization, accuracy, and precision within complex, autonomous printing systems. (Image source: iStock-1322338411)

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About The CC-Link Partner Association (CLPA)

The CLPA is an international organization founded in 2000, now celebrating its 20th Anniversary. Over the last 20 years, the CLPA has been dedicated to the technical development and promotion of the CC-Link open industrial network family. The CLPA's key technology is CC-Link IE TSN, the world's first open industrial Ethernet to combine gigabit bandwidth with Time-Sensitive Networking (TSN), making it the leading solution for Industry 4.0 applications. Currently the CLPA has over 4,100 corporate members worldwide, and more than 2,000 compatible products available from over 370 manufacturers. Around 38 million devices using CLPA technology are in use worldwide.

Anyone interested in joining the organization can apply here: <https://www.cc-link.org/en/clpa/members/index.html>

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