Who serves the servos

Powering next-gen servos with the right network technology

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The capabilities of servos are advancing at an accelerating pace, driving the rapid growth of next-level motion control systems. These devices can enable innovative industrial automation applications and processes thanks to cutting-edge hardware, software and, most importantly, communications technologies that support data-intensive operations.

Tom Burke, Global Strategic Advisor at CLPA, looks at the enabling solutions that are driving servo performance.

Today's servo drives are truly a thing of engineering beauty. They are able to meet exacting requirements for accuracy, precision and dynamism by offering fast cycle times in the microsecond scale and the ability to synchronize hundreds of axes. As a result, machines can move faster, in a highly repeatable manner, increasing productivity and throughput. Mitsubishi Electric's servos, in particular, are known for their advanced encoders, with high resolutions to detect vibrations and harmonics, as well as algorithms to dampen them.

Advanced servos also offer key tools, such as auto-tuning, to easily and efficiently set up complex machines while also optimizing drive operations. In effect, it is possible to reduce the settling time, control overshoot as well as suppress vibration

and resonance via servo gain adjustment functions. As a result, users can benefit from quieter servo axes that consistently operate at their best cycle times and at peak performance while reducing energy usage, downtime and maintenance activities.

Moving into the realm of business intelligence, competitive and future-oriented servos can benefit from condition monitoring and predictive maintenance using artificial intelligence (AI). More precisely, sensors on servo amplifiers and motors can generate accurate, real-time data on the status of internal components and mechanical devices linked to the drives. This information is then fed to machine learning (ML) algorithms to enable predictive maintenance recommendations, identify anomalies and flag potential issues ahead of time. Thanks to the application of AI, it is therefore possible to fix any wear and tear only when it is needed, preventing failures from occurring and optimizing maintenance schedules.

Combining bandwidth and TSN to futureproof servos

All these advanced functionalities, which can open the door to new and improved systems, are backed by equally sophisticated industrial communications that leverage the latest, most promising technologies. High-bandwidth, high-speed industrial Ethernet and Time-Sensitive Networking (TSN), in particular, are playing a key role in driving the speed, accuracy and all data-driven functions of servos forward.

More precisely, real-time gigabit transmissions can support the immediate transfer of large volumes of data from servos to controls and vice versa. This is ultimately enabling the creation of systems with ever-shortened pulse widths for increasingly demanding applications. TSN, on the other hand, can improve synchronization accuracy, thanks to the IEEE 802.1AS standard, and support the sharing of different

types of data traffic. Therefore, it empowers servos to transmit and receive diverse data packets, such as time-critical messages for control operations as well as less transient information, e.g. for AI analytics and predictive maintenance, without congestions or delays.

While 1Gbits transmission speed and TSN, taken individually, can help servos deliver state-of-the-art capabilities, when integrated into a single network technology, they have a synergistic effect. The combination of the two enables servos to deterministically handle large volumes of data of any kind at high speed, so that they can be smart and effectively support digital manufacturing applications. Currently, the only network technology that offers both features is the open industrial Ethernet CC-Link IE TSN. As the first solution for industrial communications with TSN functions, CC-Link IE TSN is already being used by automation vendors to deliver unprecedented performance. When looking at servos, a prominent compatible product is Mitsubishi Electric's MELSERVO MR-J5, coupled with motors equipped with the company's encoders.

Industry-leading performance for smart manufacturing

The incorporation of gigabit bandwidth and TSN deliver enhanced performance across MR-J5 multi-axis servo systems. In effect, it ensures that the drives can be connected with a multitude of devices – including safety equipment, which can be linked on the same network as standard control products, like inverters, HMI and I/O. Even more, it is possible synchronize up to 256 axes.

Thanks to the MR-J5's compatibility with CC-Link IE TSN, users can also benefit from communication cycle times of 31.25µs and a frequency response of 3.5kHz. Ultimately, it is possible to reach a maximum motor speed of 6,700 r/min. This high-level performance does not come at the cost of a more complex set-up process, as

a quick auto-tuning function generates all of the gain values automatically within approximately 0.3 seconds.

When it comes to additional analytics for business intelligence, CC-Link IE TSN supports the AI-driven predictive maintenance functions within the MR-J5. These are used to detect mechanical component deterioration on the machine long before any maintenance requirements arise, optimizing scheduling and ensuring uptime. Finally, CC-Link IE TSN also supports Simple Network Management Protocol (SNMP), enabling information technology (IT) applications to access such components for asset monitoring and management.
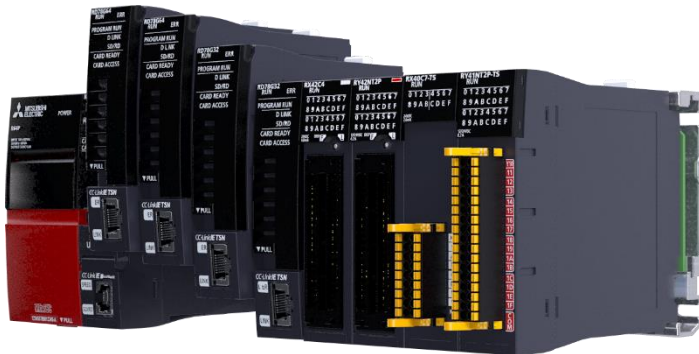
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Image 1: The incorporation of gigabit bandwidth and TSN deliver enhanced performance across Mitsubishi Electric's MELSERVO MR-J5 multi-axis servo systems. ©Mitsubishi Electric

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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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