EtherCAT® Technology Group

Flexibility in topology, automatic addressing and inherent cybersecurity are just a few advantages of EtherCAT in the smart distribution center of today and tomorrow

EtherCAT gains the home-field advantage in intralogistics

Intralogistics is a home game for EtherCAT: In hardly any other industry do the unique selling points of the technology have such an advantageous effect. Due to its unique functional principle, EtherCAT provides a number of special features that no other industrial Ethernet technology or traditional fieldbus system can offer.

Let's start with the topology. For conveyor systems, tilt-tray sorters, storage and retrieval machines (SRM) and the like, line topology is the ideal match. EtherCAT has no issue whatsoever with line topology since it is not switch-based. I have seen material handling systems that required dozens of Ethernet cables to be run to the central switch located in the control cabinet in order to avoid cascaded switches. With EtherCAT, however, just one cable is enough. But EtherCAT is not limited to the line topology; drop lines, tree and star topologies, as well as hot connect of network segments and even cable redundancy, are supported as well, the latter with standard devices – that is, no need for special cable redundancy devices. So the EtherCAT topology follows the application, not vice versa. This also applies to the number of nodes: EtherCAT can handle up to 65,535 in one segment, with 100 m between two nodes on copper cable, or 20 km on fiber optics. Of course one can switch between the physical layer options any number of times.

Next is its ease of use: There is no need to handle MAC addresses or IP addresses, configure switches or routers or call the IT department for help. EtherCAT distributes node addresses automatically and makes sure that there is no address overlap. Whereas configuring and double checking IP addresses in a large industrial Ethernet network can take days, EtherCAT does all this with a mouse click.

EtherCAT is best known for its outstanding performance. Even in large networks, the EtherCAT cycle time matches the performance of the fastest industrial controllers such as PC-based systems, thus leading to an extremely short reaction time. And in many intralogistics applications, it is the reaction time that limits the system throughput. If the reaction on the moving part is faster, the movement can be faster. In a world of next-day or even same-day delivery, performance of the equipment is paramount and EtherCAT meets this challenge.

Physically, EtherCAT is a peer-to-peer system: Each node generates the physical signal from scratch, so unlike with traditional fieldbus systems, noise does not travel beyond the next node in an EtherCAT system. This makes EtherCAT very robust. And the unique diagnostic capabilities go even further: EtherCAT not only detects bit errors, it also localizes them. Even a loose connector is detected and localized. So if there is a physical layer issue, it can be found and fixed quickly.

Cybersecurity is becoming increasingly important in intralogistics systems, which provides additional home-field advantages. EtherCAT is not based on the Internet protocol, thus malware cannot travel over EtherCAT. In an EtherCAT network, only EtherCAT frames are forwarded. Thus other Ethernet

WITRON became member 5,000 of ETG in 2019, adding to the number of high-profile intralogistics providers in the organization.

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*Based on rankings from Modern Materials Handling, 2019

frames – including those that contain malware – are filtered out in hardware by the slave controller chips. Man-in-the-middle attacks are also not possible since the EtherCAT master controls the behavior of all slave devices. So like the traditional fieldbus systems, EtherCAT systems also fly underneath the radar of the IT department and do not require special cybersecurity attention: EtherCAT is the Ethernet fieldbus.

Functional safety is another crucial part of any intralogistics application. Safety over EtherCAT (FSoE) covers that ground with a flexible approach that allows one to add a distributed functional safety subsystem to a non-safe control architecture. Furthermore, Safety over EtherCAT is supported by more vendors than any other safety protocol in the industry.

Speaking of supplier variety: EtherCAT is an open technology supported and maintained by the world's largest fieldbus organization. EtherCAT Technology Group (ETG) has more than 5,600 member companies from 66 countries, out of which about 3,000 have officially registered as EtherCAT product vendors. EtherCAT is an international standard originally developed by Beckhoff. And since Beckhoff is the inventor of EtherCAT, the company's TwinCAT automation software is considered the gold standard of EtherCAT masters. Hence, every device vendor of course not only uses the official conformance test tool as required by ETG rules, but also tests its product against TwinCAT software.

Supplier variety also is the prerequisite for fair pricing and fully featured products: EtherCAT vendors cannot get away with overcharging or poor implementations, neither on the chip side nor on the device side. Since EtherCAT only needs an Ethernet port on the master hardware and does not need switches, one also eliminates infrastructure components, further reducing system cost. And since commissioning time and troubleshooting are shortened due to the combination of simplicity and diagnostic features, total cost of ownership is lower by default.

The features of EtherCAT match the requirements of the global intralogistics industry extraordinarily well. So its widespread adoption should come as no surprise. The majority of the world's top 10 materials handling system suppliers rely on EtherCAT, and half are ETG members.

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