Why use EtherCAT?

The unique way that EtherCAT works makes it the clear "engineer's choice." Additionally, the following features are particularly advantageous for many applications.

1. Exceptional performance

EtherCAT is by and large the fastest Industrial Ethernet technology, but it also synchronizes with nanosecond accuracy. This is a huge benefit for all applications in which the target system is controlled or measured via the bus system. The rapid reaction times work to reduce the wait times during the transitions between process steps, which significantly improves application efficiency. Lastly, the EtherCAT system architecture typically reduces the load on the CPU by 25 – 30 % in comparison to other bus systems (given the same cycle time). When optimally applied, EtherCAT's performance leads to improved accuracy, greater throughput, and thus to lowered costs.

2. Flexible topology

In EtherCAT applications, the machine structure determines the network topology, not the other way around. In conventional Industrial Ethernet systems, there are limitations on how many switches and hubs can be cascaded, which thus limits the overall network topology. Since EtherCAT doesn't need hubs or switches, there are no such limitations. In short, EtherCAT is virtually limitless when it comes to network topology. Line, tree, star topologies and any combinations thereof are possible with a nearly unlimited number of nodes. Thanks to automatic link detection, nodes and network segments can be disconnected during operation and then reconnected – even somewhere else, if the master supports this feature. Line topology is extended to a ring topology for the sake of cable redundancy. All the master device needs for this redundancy is a second Ethernet port, and the slave devices already support the cable redundancy anyhow. This makes switching out devices during machine operation possible.

3. It's simple and robust

Configuration, diagnostics, and maintenance are all factors that contribute to system costs. The Ethernet fieldbus makes all of these tasks significantly easier: EtherCAT can be set to automatically assign addresses, which eliminates the need for manual configuration. A low bus load and peer-to-peer physics improve electromagnetic noise immunity. The network reliably detects potential disturbances down to their exact location, which drastically reduces the time needed for troubleshooting. During startup, the network compares the planned and actual layouts to detect any discrepancies. EtherCAT performance also helps during system configuration by eliminating the need for network tuning. Thanks to the large bandwidth, there is capacity to transmit additional TCP/IP together with the control data. However, since EtherCAT itself isn't based on TCP/IP, there is no need to administer MAC-addresses or IP-addresses or to have IT experts configure switches and routers.

4. Integrated Safety

Functional safety as an integrated part of the network architecture? Not a problem with Functional Safety over EtherCAT (FSoE). FSoE is proven in use through TÜV certified devices that have been on the market since 2005. The protocol fulfills the requirements for SIL 3 systems and is suitable for both centralized and decentralized control systems. Thanks to the Black-Channel approach and the particularly lean Safety-Container, FSoE can also be used in other bus systems. This integrated approach and the lean protocol help keep system costs down. Additionally, a non-safety critical controller can also receive and process safety data.

5. Affordability

EtherCAT delivers the features of Industrial Ethernet at a price similar or even below that of a classic fieldbus system. The only hardware required by the master device is an Ethernet port – no expensive interface cards or co-processors are necessary. EtherCAT slave controllers are available from various manufacturers in different formats: as an ASIC, based on FPGA, or also as an option for standard microprocessor series. Since these inexpensive controllers shoulder all the time-critical tasks, EtherCAT itself doesn't place any performance requirements on the CPU of slave devices, which keeps device costs down. Since EtherCAT doesn't require switches or other active infrastructure components, the costs for these components and their installation, configuration, and maintenance are also eliminated.

For these reasons, EtherCAT is often seen in:

- Robotics
- Machine tools
- Packaging machines
- Printing presses
- Plastic manufacturing equipment
- Presses
- Semiconductor manufacturing machines
- Test benches
- Pick & Place Machines
- Measurement systems
- Power plants
- Substations
- Material handling applications
- Baggage handling systems
- Stage control systems
- Automated assembly systems
- Pulp and paper machines
- Tunnel control systems
- Welding machines
- Cranes and lifts
- Farm machinery

- Offshore applications
- Sawmills
- Window manufacturing equipment
- Building automation systems
- Iron and steel works
- Wind turbines
- Furniture manufacturing equipment
- Milling machines
- Automated guided vehicles
- Entertainment automation
- Medical devices
- Woodworking machines
- Flat glass manufacturing equipment
- Weighing systems

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