Safe data transmission with Safety over EtherCAT

What is Safety over EtherCAT?

Functional safety is an integral part of modern network architectures and communication systems. EtherCAT offers the possibility of safety-related data transmission in parallel with standard data on the same network with the help of the Safety over EtherCAT protocol (FSoE = FailSafe over EtherCAT). With Safety over EtherCAT, the communication system is part of a Black Channel (Fig. 1), which is not considered to be part of the safeguarding of the data. Safety over EtherCAT is a TÜV-certified technology developed according to IEC 61508 and standardized internationally in IEC 61784-3.

The safety data is embedded in the standard process data as a container (Fig. 2) combined with additional data for its integrity. The safety connection between the FSoE master and an FSoE slave is fully monitored in each safety cycle: The checksum of the safety frames, the connection ID and also a watchdog time for each FSoE frame transmission are all checked.

Safety over EtherCAT

Integration of Safety over EtherCAT

Device manufacturers appreciate the concise FSoE specification that offers easy and high-performance implementation.

The EtherCAT Technology Group (ETG) provides extensive support for FSoE implementation and certification of a device, as well as during all stages of its lifecycle. In addition, official tools and services in order to help device vendors achieve conformance with the specification are available.

Available pre-certified software stacks also help reduce integration time. The wide range of support services offered by various providers makes it easy to integrate Safety over EtherCAT into a product portfolio: “Make or Buy” – with Safety over EtherCAT, the choice is always yours.

ETG, in close coordination with TÜV, has defined requirements for the use of FSoE and developed conformance tests (Fig. 3). As a result, a Safety over EtherCAT Conformance Test Tool for automated testing of FSoE implementations and an FSoE test service provider are available.

Read more about safety:
www.ethercat.org/safety

Fig. 1: Thanks to the Black Channel principle, the standard communication interface can be used.

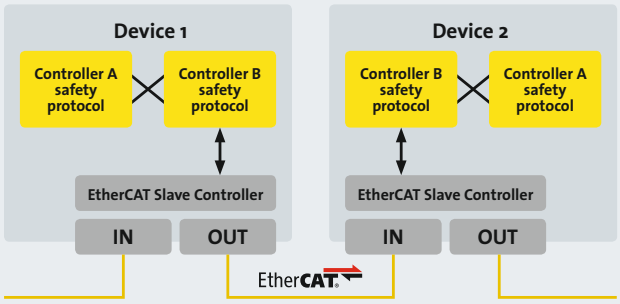


Fig. 2: The FSoE frame (safety container) is embedded in the process data of the cyclic communication.

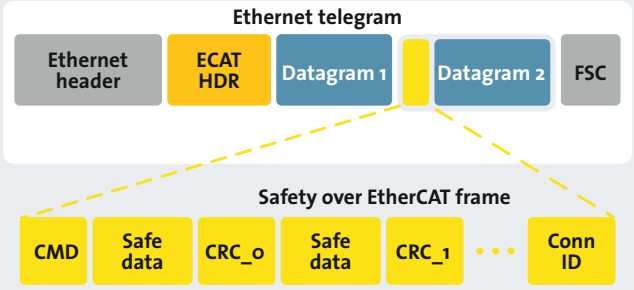
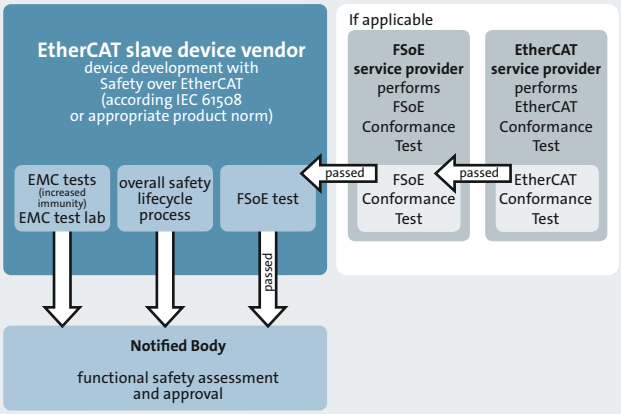


Fig. 3: Conformance: device assessment and approval



EtherCAT Technology Group

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Plant-wide safety solution

Independence from the communication system also simplifies the safety-relevant networking of plant components. The Safety over EtherCAT container is routed via standard EtherCAT devices and controllers and evaluated from one part of the system to the other (Fig. 4). Comprehensive emergency stop functions and targeted shutdown of machine modules are therefore easy to implement, even if they are linked to each other via other communication systems such as basic Ethernet.

How does the demo work?

The Safety over EtherCAT demo (Fig. 5) shows devices from different manufacturers: two EtherCAT networks representing different machine modules, each with its own EtherCAT master. The main strand features a decentralized safety control system from **Beckhoff**, which is connected to safety I/O from **Weidmüller** and a safety encoder from the company **TR-electronic** as well as a drive controller with safety functions from **Stöber**.

The safety controller evaluates the safety sensors connected to the decentralized safety I/O assembly: A local emergency stop button, a light curtain from **SICK** and a laser scanner from **Leuze**. If the light curtain is interrupted or the emergency stop button is pressed, the drive is set to safe state SS1 (safe stop 1). A hold must be acknowledged by pressing the RESET button and then the restart must be initiated with the START button.

When approaching the laser scanner, the SLS (safely-limited speed) function is first activated in the drive and the saw blade runs at a reduced speed. If a certain distance limit is reached, the SS1 is triggered. When the operating mode switch is set from AUTO to MANUAL, the drive stops and can then be operated by hand with the wheel at the encoder at a safe speed for machine set-up.

The emergency stop button in the second network (i.e. machine module) is connected to a safety I/O assembly and is evaluated by the safety controller from **Lenze**. There is a Safety over EtherCAT connection between this safety controller and the Beckhoff safety controller, which is routed via the standard EtherCAT master and an Ethernet connection. This shows a plant-wide emergency stop function: The blade can also be safely shut down via the second machine network.

Fig. 4: Example of plant-wide safety communication

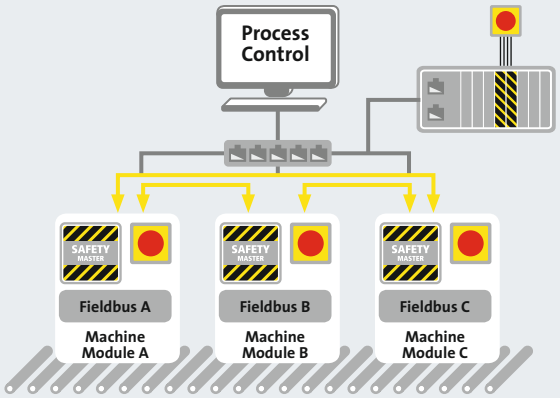

Fig. 5: Functional multi-vendor Safety over EtherCAT demo

What is EtherCAT?

EtherCAT (Ethernet for Control Automation Technology) is an open Industrial-Ethernet solution. EtherCAT sets new standards with respect to real-time performance, low costs, flexible topology and ease of use.

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