Communicate flexibly and continuously with Sercos

In addition to real-time and safety-critical data, the Sercos transmission principle makes it possible to transmit any other Ethernet protocol, such as EtherNet/IP and TCP/IP, via a common network infrastructure. Additional cable or additional network components, such as gateways or switches, are not required for this. To keep the cyclic and clocked communication of Sercos III intact, the non-Sercos protocols are sent on the Unified Communication Channel (UCC), which is an integral part of the Sercos transmission. This standard and multi-protocol-capable network infrastructure enables engineers and users to reduce the costs and complexity of machine integration. At the same time, they can retain their preferred product suppliers and automation devices without additional hardware expense.

Introduction

An increasing number of manufacturers are using Industrial Ethernet solutions to implement new machine concepts and to connect systems. The advantages over traditional fieldbus systems are obvious. There is sufficient bandwidth available to transmit safety-critical data as well as IT protocols via a common medium in addition to fast real-time data transmission.

In addition, users and manufacturers benefit from the use of standardized Ethernet hardware, such as passive and active infrastructure components. However, a uniform standard remains a dream: There is a large number of competing communication solutions, and although they all use the Ethernet technology, they specify different protocols and profiles in the superimposed ISO/OSI layers. Thus, devices that support different Industrial Ethernet standards are not compatible with each other or interoperable. Moreover, most devices that support various real-time Ethernet protocols cannot coexist in a network. Most real-time Ethernet solutions use the network on an exclusive basis, meaning that only devices of one's "own" protocol can be operated on the network. Devices that support other real-time Ethernet protocols, as well as standard Ethernet participants, can be connected only via gateways or special switches (figure 1).

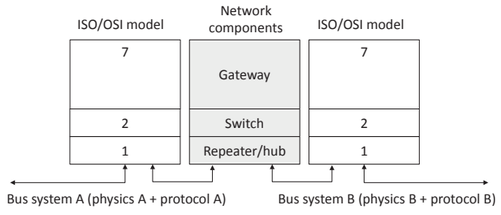

Figure 1: Use of network components to couple bus systems

Gateways make it possible to combine heterogeneous bus systems – bus systems that differ in terms of their characteristics and protocol – with each other. However, such protocol converters are highly complex, since the gateway integrates into two bus systems and the mapping of the protocols and data must be configured. Equipment costs are also correspondingly high. A more economical and simple solution for coupling networks or network segments are switches. However, this requires that the coupled bus systems be of the same type (e.g., coupling of Fast Ethernet with Gigabit Ethernet) and that the "foreign" protocols do not hamper the correct behavior of the real-time Ethernet solution.

Sercos® is pursuing a different path, as the Sercos transmission process allows Sercos devices and other Ethernet devices to be combined without additional hardware. A logic system integrated into each Sercos device allows the direct connection of Ethernet devices (see figure 2a). The integrated switch monitors compliance with a defined period of time so that the real-time behavior of the Sercos network is not negatively hindered. This process also allows an external switch (see figure 2b) to be connected to any Sercos device.

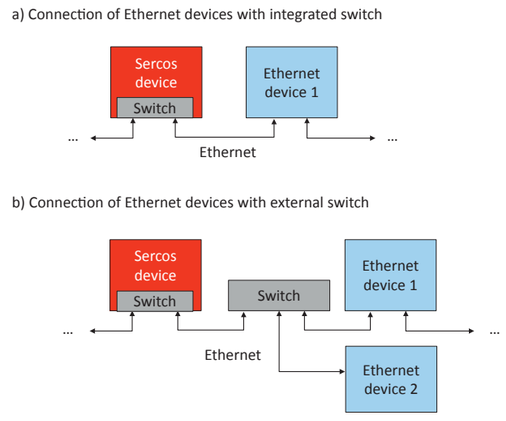

Figure 2: Use of switches to couple Sercos devices with any Ethernet devices

The Sercos transmission process

The Sercos transmission process is based on cyclical communication in which a Sercos III communication cycle is subdivided into two time slots (channels) using time control (figure 3). The collective telegrams specified by Sercos III are transmitted as a broadcast in the real-time channel, and are processed by the Sercos III devices during the cycle. In contrast, any other Ethernet telegrams can be transmitted in the UCC. Communication cycles and the division of the 100 Mbit/s bandwidth into the real-time and UCC can be adjusted for each application. The highly efficient Sercos telegrams ensure that only a part of the bandwidth is used for the real data exchange.

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For example, Sercos needs only about 400 microseconds of a 2-millisecond cycle for an application with 64 drives. Thus, there are 1.6 milliseconds available for the transmission of other protocols. Since the UC Channel sits directly on the Ethernet layer, any Ethernet user can be connected to the network without any additional hardware. Tunneling of the protocols is not required. Even before a Sercos III communication is initiated by the master, the network users can exchange data, for example via TCP/IP or the S/IP protocol specified by Sercos.

Since the common use of the cable has no negative impact on the real-time behavior of the various protocols, they remain fully functional even in a common network infrastructure. Since the corresponding communication mechanisms are already an integrated component of the Sercos transmission process, existing specifications do not need to be altered with respect to this. Only a few simple installation rules are to be followed when setting up the network infrastructure. »

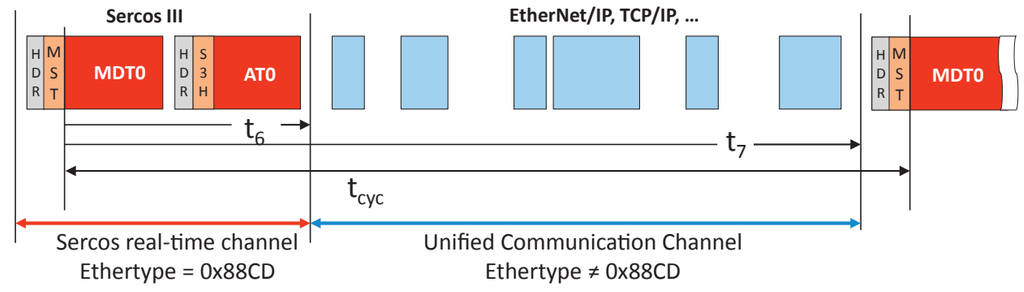

Figure 3: Transmission of Sercos, EtherNet/IP and TCP/IP protocols via a cable using a time-multiplex procedure

Application example: Multi-protocol-capable infrastructure for Sercos and EtherNet/IP

To clarify the possible application, the combination of Sercos and EtherNet/IP devices is considered in the following: To control a mixed Sercos and EtherNet/IP network infrastructure, a Sercos master and an EtherNet/IP scanner are required. These functionalities can be combined in one single device (a dual stack master, see figure 4). If no redundancy is required, the devices are connected in a line topology. When the last Sercos device identifies a Sercos-unknown device on its second Ethernet port, it transmits only non-Sercos telegrams which are destined for other devices. In the reverse direction, the device transmits incoming telegrams via the first Ethernet port to the dual stack master and uses the UCC to this end. Standard Ethernet telegrams which come in during the time reserved for the real-time channel will be retained and subsequently transmitted.

When the application requires a Sercos ring for redundant data transmission of real-time data and therefore no free Sercos port is available, an IP switch must be integrated into the ring. Its function is to connect and disconnect the EtherNet/IP packets into the Sercos ring. The EtherNet/IP devices can be arranged in different topology types: star and line topologies as well as Device Level Ring (DLR). The common infrastructure complements the Sercos solution portfolio, as in addition to the extensive Sercos III product range, EtherNet/IP devices of any manufacturer can now also be used. With this concept, the number of communication interfaces and therefore the hardware complexity in machines and facilities are significantly reduced. The continuous networking increases the operating efficiency in engineering and in the operation of the facilities.

Summary

With Sercos III, one solution covers the entire range of communication needs in production: vertical integration with office systems, synchronous control of multi-axis systems, data transfer between decentralized controls, and the guaranteed transmission of safety-relevant information. The multi-protocol capability of Sercos makes it possible to transmit various communication protocols simultaneously via a common and uniform network infrastructure. For example, EtherNet/IP and TCP/IP devices can coexist with Sercos devices without the real-time characteristics or the functionality of the individual protocols being hindered. Thus gateways are not required, since the various protocols can coexist and do not need to be mapped onto each other.

This promotes the necessary efficiency required for economical development of modern machines and facilities. Thanks to Sercos, anyone who wants to develop their machines and facilities economically and easily can limit themselves to one solution and one cable for all applications, without having to accept losses in terms of flexibility and safety.

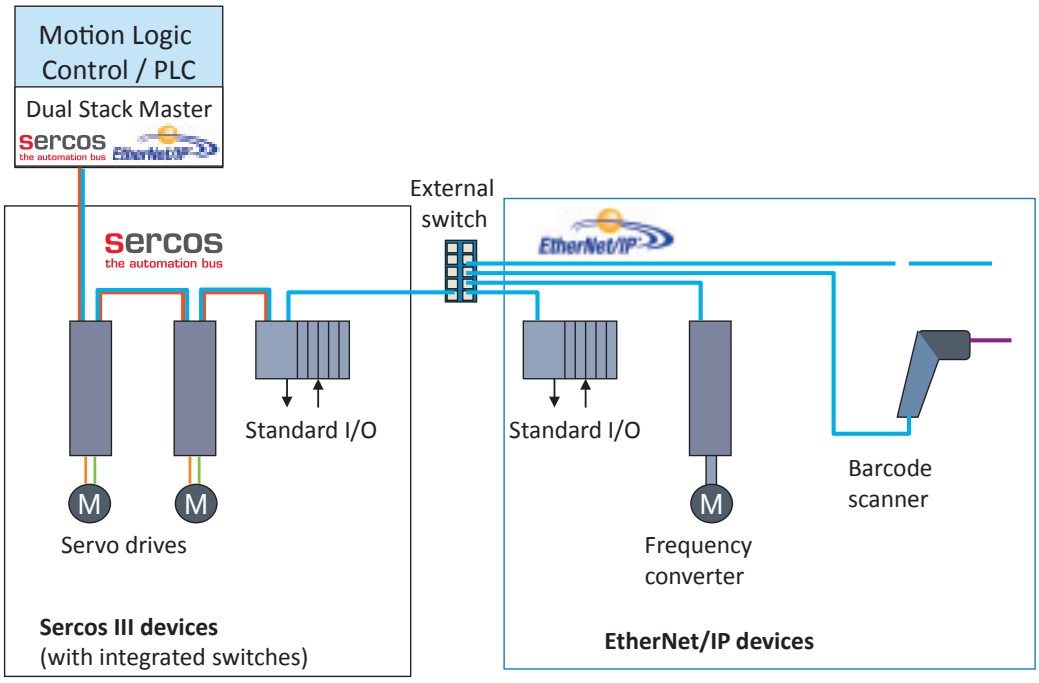

Figure 4: Combination of Sercos III and EtherNet/IP devices using the example of a line topology