sercos
news
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Evolution or revolution?

Ethernet TSN
Network communication with hard real-time requirements

OPC UA and Sercos
OPC UA Companion Specification for Sercos available

Sercos makes waves
Highest requirements for sea wave simulation fulfilled

Dear readers,

The blending of the digital world with the physical thanks to the Internet heralds the start of the intelligent factory era. Flexibility, efficient use of resources, improved ergonomics, and integrating customers and business partners into the business and value-creation processes, are all features of this blending process.

Information and communication technologies play a key role in implementing Industry 4.0 concepts. Today's automation bus systems must not only guarantee that machines and facilities can carry out production with safety and precision; they must also help establishing a universal solution for integrating different IT systems on different rungs of the organizational ladder within a factory.

As a universal automation bus, Sercos® is very well prepared to meet these demands to the satisfaction of users and suppliers. Excellent performance, a multi-protocol-enabled network infrastructure, a universal manufacturing data model to unify the exchange of information within machines and facilities, and superior IT systems make Sercos the first choice for countless market leaders in machinery and plant manufacturing.

With the new OPC UA Companion Specification, Sercos International is at the forefront of matching OPC UA with underlying real-time communication systems. Moreover, Sercos International has started early to evaluate the future real-time standard IEEE 802.1 TSN (Time-Sensitive Networks) regarding its suitability for high-speed and real-time machine communication.

In this current edition of Sercos News you will find reports about the latest developments and trends related to the Sercos automation bus.

We hope you enjoy reading.

Peter Lutz
Managing Director
Sercos International e.V.

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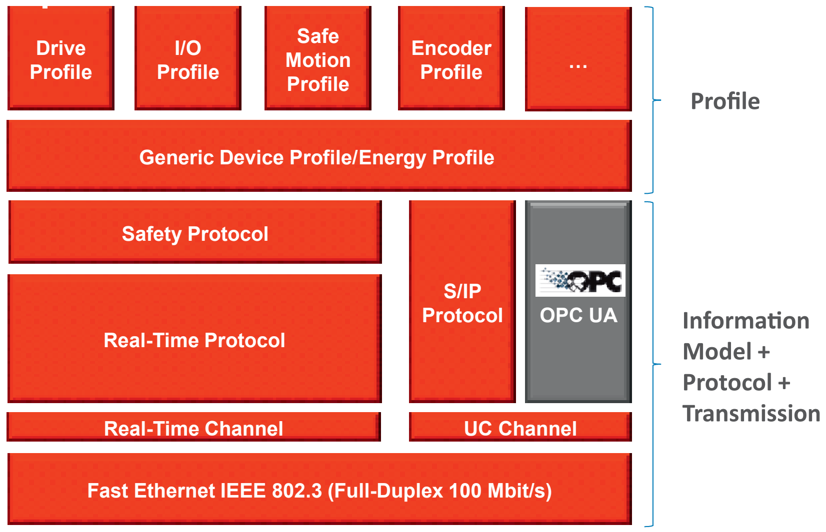


OPC UA Companion Specification for Sercos released

Sercos International has recently released the OPC Unified Architecture (UA) Companion Specification for Sercos. This specification describes the mapping of the Sercos information model to OPC UA so that functions and data of Sercos devices are made available and accessible via OPC UA.

This initiative aims at simplifying the communication between machine periphery and supervisory IT systems, supporting the requirements of Industry 4.0 regarding semantic interoperability.

The OPC UA Companion Specification for Sercos® is the result of a "call for experts" launched by Sercos International in September 2014. A first draft of the Sercos OPC UA Companion Specification was made available in November 2014. The following review was executed by a technical working group consisting of device manufacturers, technology providers and research institutes. The final specification was published in early November 2015 as release V 1.0.

In today's automation systems Sercos devices from many different manufacturers have to be integrated and maintained, resulting in significant total cost of ownership (TCO) during the entire product life cycle. At the same time product planning and control require process- and machine-related information to facilitate the efficient use of the manufacturing resources. This challenge can be faced best with a standardized OPC UA Sercos information model that brings together the well-defined device profiles of Sercos with the data exchange standard of OPC UA. Use cases cover a broad range from device parametrization and network configuration up to energy management and preventive maintenance.

The mapping rules specified by Sercos can be used for different implementation approaches. On the one hand, the OPC UA server functionality can be implemented in a Sercos master device (e.g. CNC or PLC). On the other hand, it is possible to implement this functionality in a Sercos slave device. In the latter case, the OPC UA accesses are executed in parallel to the Sercos real-time communication or even without any Sercos real-time communication.

Sercos III Open Source SoftMaster Core available

Sercos International provides Sercos III SoftMaster Core as open source software.

By using a Sercos® III SoftMaster, a Sercos III master device can be implemented without specific FPGAs or ASIC Sercos III hardware controller. Instead, a standard Ethernet controller is used and the Sercos III hardware functions are emulated in a host-based driver software. With this implementation approach, a sufficient real-time performance can be ensured for a large number of applications. If an Ethernet controller is used that operates with multiple queues and a telegram scheduler (e.g., the Intel i210™), a synchronicity similar to that of a hardware-based master can be achieved.

Various prominent companies have already started to implement projects using the Sercos III SoftMaster in cooperation with Bosch Rexroth AG. After a controlled testing period, the SoftMaster will be made available under an open source license for general use in the software pool of Sercos International e.V. The license model will follow the one used for the Sercos III master library CoSeMa (Common Sercos Master; http://sourceforge.net/projects/cosema/), which has been available as open source since April 2009 and can be used for hardware-based as well as software-based master implementations.

With the availability of the Sercos III SoftMaster implementation as open source, it becomes much easier for manufacturers to develop a Sercos III master and to benefit from future improvements and extensions of the software. Control systems can thus be designed to be simpler, more compact and at reduced costs.

Sercos SoftMaster V release and videos

The first V release of the Sercos SoftMaster Core is available as a download under SourceForge (http://sourceforge.net/projects/sercos-softmaster-core/).

The Sercos International YouTube channel provides videos explaining the functioning of the SoftMaster.

Sercos International – working group for Ethernet TSN established

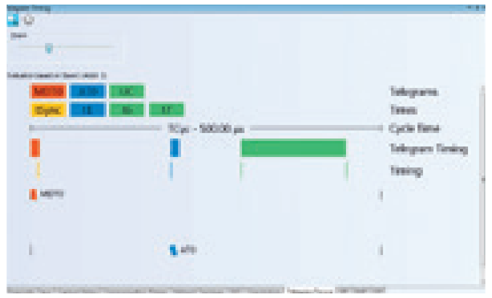
Sercos International announced at the SPS IPC Drives 2015 that a working group will evaluate the future real-time Ethernet standard IEEE 802.1 TSN (Time-Sensitive Networks) with regard to its suitability for high-speed real-time machine communication.

Ethernet TSN comprises a series of IEEE 802 substandards, that are currently elaborated by the IEEE TSN working group and that will most probably be released until 2017. The new standards include, among others, time-triggered data transmission (IEEE 802.1Qbv Scheduling), bandwidth reservation (IEEE 802.1Qcc Stream Reservation), as well as measures to interrupt not time-critical data streams (IEEE 802.1Qbu Frame Preemption). Thus, a completely deterministic communication within the IEEE 802 standard is possible. At the same time additional protocols (streams) may be transmitted over the same medium without affecting the real-time characteristic of the network.

The newly established Sercos® TSN working group will evaluate the future IEEE 802.1 TSN standard especially with respect to the achievable network performance (data throughput, latency times and real-time characteristic), as well as the required network management associated with different network configurations. The results are analyzed in order to derive possible implementation and migration concepts for different use cases.

For the first time in the history of Ethernet, Ethernet TSN allows a time-triggered transmission of real-time critical messages via standard Ethernet components. An exciting and crucial question is now, whether and how high-speed real-time applications can be realized with Ethernet TSN. The advantages of using Ethernet TSN are obvious: Standard Ethernet hardware with integrated real-time capability can be used, which would result in low costs and a wide range of products and manufacturers. In addition, TSN can make an important contribution to the implementation of consistent IoT solutions and to the improvement of the coexistence of real-time Ethernet and Internet protocols.

Picture 1: Oscilloscope function



Picture 2: Graphical visualization of the Sercos timing

Sercos Monitor version 3.0 with numerous new features

A new version of the Sercos Monitor with numerous new features is available for download from the website of Sercos International.

The diagnosis tool is continuously further developed by the Steinbeis-Transferzentrum Systemtechnik in Esslingen (Germany) in order to facilitate a comprehensive and detailed analysis of the data traffic in Sercos® III networks.

The new version supports the new features of Sercos version 1.3.1, as well as the recording and analysis of CIP Safety frames, the S/IP protocol and hot-plug procedures in a Sercos III network. Special highlights are the oscilloscope function and a graphical visualization of the Sercos timing.

With the oscilloscope function signals can be visualized for easy analysis of value-over-time. The free configurability supports a broad variety of application options. For example, actual torque and speed values can be visualized individually or even collectively (see picture 1).

The graphical visualization of the Sercos timing provides a quick and easy overview on the structure of the configured Sercos communication cycle (MDT, AT and UC Channel or MDT, UC Channel and AT; see picture 2).

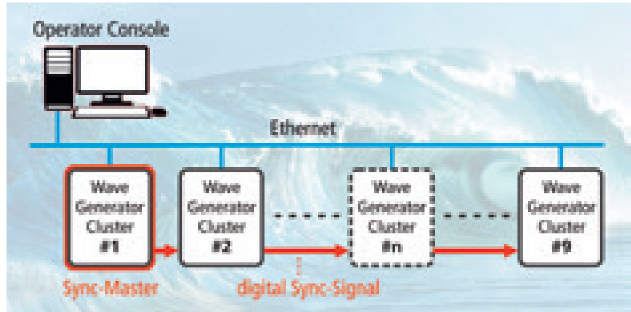
Optimizations and improvements also relate to the execution of long-term measurements to record and analyze sporadic errors. Furthermore, additional monitoring functions (e.g. communication phase change, SVC timeouts and connection monitoring), enhancements of the Telegram Expression Language for a more exact definition of trigger and filter conditions, and enhancements to the Diagnostic Trace were implemented.

Furthermore, with the new version, a direct export of the Sercos Monitor configuration from the CoSeMa open source driver is possible. This eliminates the need to create the configuration of the Sercos Monitor based on a conducted phase switching.

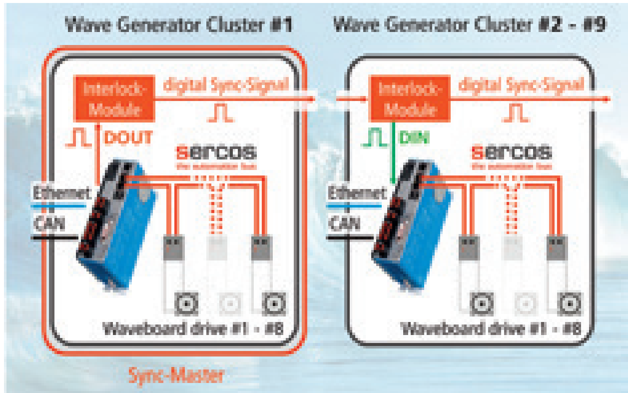
Sercos makes waves

A plant to generate waves under controlled conditions uses 72 drives – operated in clock-synchronous mode and arranged in single clusters, each with own Sercos master and eight servo drives.

The plant equipped by Akamina Technologies simulates sea waves in a water basin. The simulation has high demands on precision of height and frequency of the waves as well as on their reproducibility. The hereto necessary precise motion of the wave boards used for the creation and active absorption of waves is reached by the clock-synchronous operation of the wave board drives distributed across single clusters. Picture 1 shows the plant structure consisting of overall nine clusters.



Picture 1: Plant structure with nine drive clusters



Picture 2: Structure of a drive cluster

Each cluster (picture 2) is controlled by a Cannon-Automata A2-PAC controller. The eight drives for moving the wave boards are connected to its integrated Sercos master interface. Each of the 72 wave boards has a stroke of 1 m and can be moved with a maximum velocity of 1,000 mm/s. The wave generator, a software module running on the A2-PAC, calculates the velocity command values. The wave generator provides support for active wave absorption for both 2-D and 3-D waves. This is accomplished by measuring the actual wave height along the surface of each wave board using a sensor connected to the CAN interface of the A2-PAC and comparing it to the expected wave height. The active wave absorption method used by Akamina Technologies uses a velocity controller that tracks the desired velocity and the corresponding desired wave height at the same time. When computing the desired velocity of the wave board, the control algorithm looks at the difference between the desired and measured wave height and converts this to a velocity correction. The velocity correction is added to the desired velocity, which the controller then tracks.

For steady wave heights and wave frequency over the whole water basin, an exact synchronization of all 72 wave boards is required. Within a cluster of eight wave boards this is already guaranteed by using Sercos® as a communication system, further effort is not necessary. The challenge of this application was the synchronization of the wave board drives across cluster boundaries. This requirement is solved using an already present Sercos master feature in combination with the A2-PAC onboard I/Os and an electronic board – the so-called interlock module – especially designed for this purpose. A signal clock-synchronous with the Sercos communication cycle of the Sercos master controlling the first cluster sets a digital output of the A2-PAC. The interlock module of the following cluster detects this signal and forwards it directly without time offset to the next cluster. Simultaneously, this synchronization signal is passed on by the interlock module to a digital input of the A2-PAC controller. The onboard logic of the A2-PAC uses this input signal to trigger the communication cycle of the integrated Sercos master without time delay.

This method allows the clock-synchronous operation of multiple Sercos real-time Ethernet networks. It is easy to install and requires no configuration effort. It guarantees a stable and reliable synchronization of complex modular machines and plants.

Key features of the A2-PAC controller

- Intel® Atom to Core-I CPUs
- Sercos® or Ethercat® Master
- CAN-Bus interface
- Onboard I/Os
- XD-Panel interface

Changeover made easy

Modular positioning systems offer flexibility for machine tool builders.

Everyone is talking about the high-flexibility factory: Particularly since the emergence of the buzzword "Industry 4.0", growing attention has focused on developing factory concepts that enable manufacturers to create specific products for their customers with a minimum additional investment of time and money. From packaging to filling or woodworking: Every year, companies are facing growing pressure to be able to manufacture new formats at extremely short notice. The practical production implications are essentially identical for everyone from contract fillers, who have to adapt new package sizes continuously, to in-house production divisions of major groups such as Procter&Gamble or the Coca-Cola Company. It is a daily balancing act between the dual demands of flexibility and pressure from rising costs.

Successful machine tool builders have therefore recognized that their secondary core competence (alongside their primary function of building machines for packaging, filling, cutting, etc.) is to master the format changeover and conversion processes of their machines. This takes place on two different levels:

Level 1: Format changeovers in the customer's manufacturing process

The machine must offer the flexibility required to manufacture all currently known formats at short notice and with the maximum level of automation – and ideally all the possible future formats that the customer's marketing department has not yet imagined.

Level 2: Conversion of the machine concept by the machine tool builder during the design process

The design produced by machine tool builders must be flexible enough to respond to the individual wishes of customers and the market. Once again, wherever possible, the goal is to flexibly cope with the familiar challenges of today and also with the unknown challenges of the future.

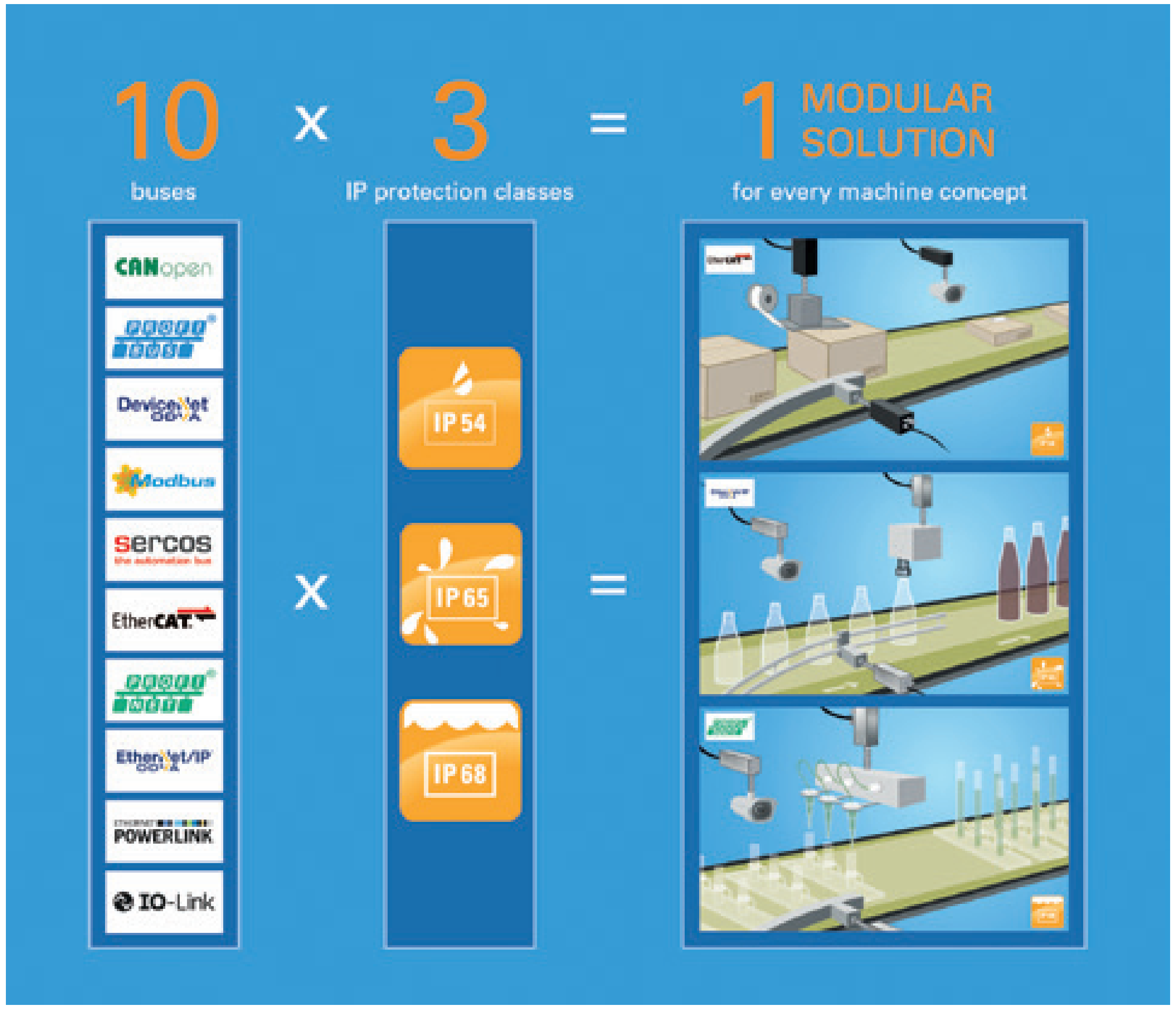
Consequently, components that assist machine tool builders on both these levels are of strategic importance. This applies especially to so-called positioning systems. These are intelligent drives, which are used in the implementation of automated format changeover systems. Equipped with a motor, gearbox, bus communication, and an absolute encoder, they automatically move guide rails, tools, or inspection cameras to the new position required for the new format. Positioning systems thus play a key role in the type of applications described under "Level 1". "Level 2" sorts the wheat from the chaff. Some positioning systems require a proprietary bus coupler that allows them to be used with the many bus communication systems (fieldbuses) available on the market. This approach is less than ideal as it requires more space and generates greater costs – particularly as special cables are also required for connecting the proprietary bus coupler. Other systems integrate a position display directly on the device itself. This forces the designer to find some installation point, that enables the user to access the display, and severely restricts the modularity and flexibility of the machine design.

halstrup-walcher, one of the international market leaders of positioning systems, focuses on compact modules, which are available via an extensive modular set:

- Torques from 1 to 25 Nm
- Selection of IP protection classes: IP54, IP65, IP68
- Selection of onboard bus communication protocols

The key advantage: When you change the IP protection class or the bus communication, all the relevant connection dimensions stay the same. This enables machine builders to "convert" an existing machine to their customer's wishes extremely quickly.

The ability to change formats and convert machinery on both these levels will be a decisive factor in determining the competitiveness of machine tool builders over the coming years. Factors that once affected only major companies in the sector are increasingly becoming the focus of attention for medium-sized machine tool builders. To quote Albert Einstein: "Life is like riding a bicycle. If you stand still, you fall over."



10 x 3 = 1 – the modular concept for positioning systems. For fast conversion of the machine to a wide range of applications.

TSN (Time-Sensitive Networking) – IEEE 802 Ethernet becomes real-time capable

Ethernet has become an indispensable part of industrial automation technology. This communication technology, which is standardized in IEEE 802, has earned wide acceptance due to its uniform technical basis, the associated interoperability, and its suitable scalability properties. However, there is one application area that standard Ethernet has been unable to penetrate so far: network communication with hard real-time requirements.

In order to cover this field of application in the future with a solution for real-time Ethernet that is standardized in IEEE 802 and accepted in the market, the Time-Sensitive Networking (TSN) task force was established at IEEE 802.1. The aim of this group is to extend existing Ethernet standards to achieve a degree of determinism that meets the hard real-time requirements of modern control networks in industrial automation and the automotive industry. This article offers a compact overview of the key components that are currently being developed within these TSN activities.

Key TSN components

The standards specified in the TSN task force can be roughly split up into three categories that are of primary importance for the overall TSN system:

- Time synchronization forms the indispensable foundation for the clocked end-to-end transmission of communication flows with hard real-time requirements.
- Scheduling and traffic shaping allow the joint transmission of data flows with hard or soft real-time requirements as well as traditional best-effort traffic in a convergent network infrastructure.
- Mechanisms for flow reservation and (redundant) path selection ensure that latency and reliability requirements are met for time-critical control flows.

The foundation: High-precision time synchronization

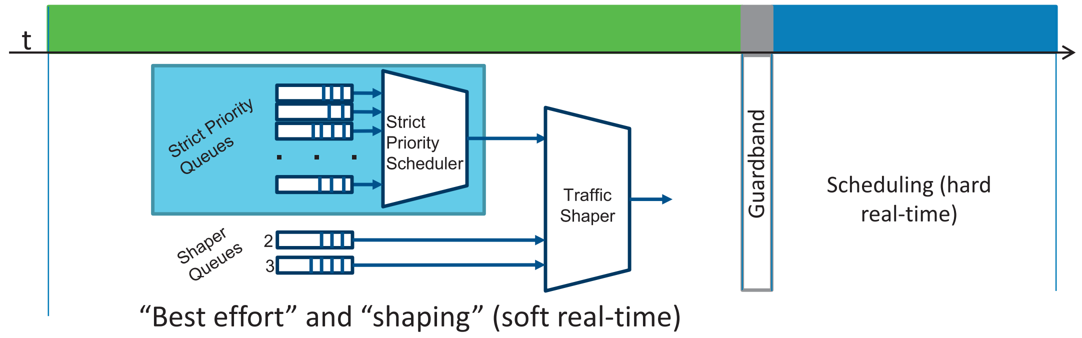
In order to transport data flows with hard real-time requirements in an Ethernet network with fixed cycles, high-precision time synchronization of all involved devices is essential. In TSN, this is achieved either through the use of the newly developed IEEE P802.1AS-Rev standard or through the use of the tried-and-tested IEEE 1588-2008 technology.

Real-time capable scheduling for soft and hard real-time

In addition to time synchronization, TSN offers mechanisms for scheduling and shaping network traffic. This enables the coexistence of different traffic categories within a single network infrastructure. For best-effort data traffic, the familiar, strict priorities in accordance with IEEE 802.1Q are used. However, one of the problems with this type of prioritization is that the sequence for data packets of equal priority cannot be influenced. Additionally, a data flow with high priority can block all other priorities on a permanent basis. Therefore, further prioritization mechanisms are required for time-critical data flows.

In TSN, shaping caters to network traffic with predictable transmission characteristics and soft real-time requirements. The related standard, IEEE 802.1Qav, defines a credit-based shaper (CBS), which prioritizes soft real-time flows over best-effort traffic in compliance with certain fairness criteria. Thus, CBS and strict priorities can already fulfill the requirements of many applications.

However, there are areas of application, particularly in the area of industrial automation and the automotive industry, that require even smaller as well as guaranteed worst-case latencies and jitter. Therefore, with TSN, cyclic transmission time windows (IEEE 802.1Qbv) are installed along the data path for time-critical data flows. During these windows, the time-critical data flows can be transmitted without hindrance (see picture 1). In addition, a guard band is set up that ensures that no data is allowed on the transmission path immediately prior to the time-critical transmission. The resulting bandwidth reduction induced by this guard band can be reduced to a minimum through the use of frame preemption (IEEE P802.1Qbu and IEEE 802.3br), i.e., the interruption of a data packet in favor of a more highly prioritized packet.



Picture 1: Connection between scheduler, CBS and "best effort"

Exceeding the baseline: Stream management and fault tolerance

Compliance with the requirements of individual applications regarding timing behavior and reliability constitutes the core of TSN. In order to ensure these characteristics, applications must register the corresponding data flows prior to their transmission. The identification, registration, and management of suitable paths can be a challenge, especially in larger networks and in conjunction with fixed transmission windows for different streams. To support the identification, registration, and management of suitable paths, TSN defines a set of mechanisms and interfaces in IEEE P802.1Qcc.

The reliability of data flows, especially in the event of errors, is also of great importance for many TSN application scenarios. For this reason, mechanisms are defined in IEEE P802.1CB and IEEE P802.1Qca that allow replication and redundant transmission of data over several disjunctive paths. Importantly, the redundancy properties achieved by these mechanisms are transparent for the communicating applications.

Timeline of the IEEE 802.1 standards and conclusion

TSN incorporates a series of standards that, combined, fulfill the requirements with respect to hard real-time data transmission. Due to the different time lines of the individual standards, the full functional scope of TSN will only be available in the course of the next few years. However, with IEEE 802.1Qbv-2015, the first standard of the TSN series is already available. Along with IEEE 802.1Qav for soft real-time requirements and IEEE 1588 for high-precision time synchronization, this TSN standard concerning transmission scheduling already allows performing the core tasks of TSN, even today.

Hirschmann Automation and Control GmbH is actively engaged in the TSN standardization process and works on supplying its customers with industrial networking equipment offering TSN functionality in the near future.

ⓘ Authors

Brief vita: Dr. Oliver Kleineberg

Dr. Oliver Kleineberg has worked for Belden, Inc., since 2007 and has been head of the Advance Development unit of Hirschmann Automation & Control GmbH – which is part of Belden's industrial IT platform – since 2015. In 2012 and 2013, he was responsible for the integration of the Tofino Security technology into Belden's Industrial Communication Portfolio. Furthermore, he has been part of various IEEE 802, IEC and ODVA task forces for many years and has made a significant contribution to industrial communication protocol specifications such as HSR and TSN. He studied Computer Engineering at the Esslingen University of Applied Sciences in Germany and received his PhD in Computer Engineering from the University of Limerick, Limerick, Ireland.

Brief vita: Stephan Kehrer

Stephan Kehrer has worked for Belden, Inc., since 2007. Since 2012, he has worked in the Future Technologies unit of Hirschmann Automation & Control GmbH, which is part of Belden's industrial IT platform. He has devoted himself mainly to the analysis and evaluation of new and future technologies in the area of industrial communication. He is involved in several research projects and is a member of various task forces of the IEEE 802 and IEC. His focus within the IEEE 802 is on the topic of time-sensitive networking (TSN). He completed his studies in computer sciences at Eberhard Karls University Tübingen, Tübingen, Germany.

Optimization of machine integration with a protocol-neutral machine model

Machinery is central to the production process and manufacturers strive to optimize how it integrates with other machines and supervisory systems in their business enterprise.

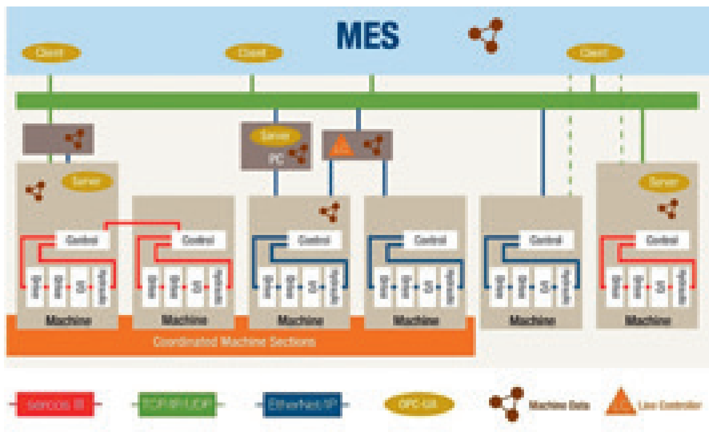
The Internet of Things is exposing many new opportunities to extract value from machines and processes through revealing valuable information from otherwise stranded data from sensors and actuators. Analyzing that new data helps in making better decisions. Manufacturers traditionally benchmark their high-value equipment by asset turnover, which measures how efficiently a company's assets generate revenue. In today's economy, however, production professionals and business executives need to have a more holistic view. In addition to asset (i.e. machinery) turnover, manufacturers must measure the ability of assets to help the enterprise meet overall business goals and adapt to rapidly changing market demands. Ease of integration is an important element of this equation.

In order to support the optimization of machinery integration, the ODVA, the OPC Foundation, and Sercos International have agreed to jointly develop an open and interoperable framework for communication, which is comprehensive, scalable, secure, open and inclusive for both manufacturers and machine builders. For machine builders, Optimization of Machine Integration (OMI™) provides opportunities for creating additional value through simplified communication between machines and from machines to supervisory systems such as SCADA and MES. By transforming data into information, OMI will provide tools for dynamic decision-making, thus maximizing machine productivity, improving machine performance, and enhancing the preventive maintenance of machinery assets. As a result, OMI will create more value from machines, will extend machinery life cycles, and will emerge as a natural sweet spot to help manufacturers meet their overall business objectives, including workforce, profitability, and sustainability goals.

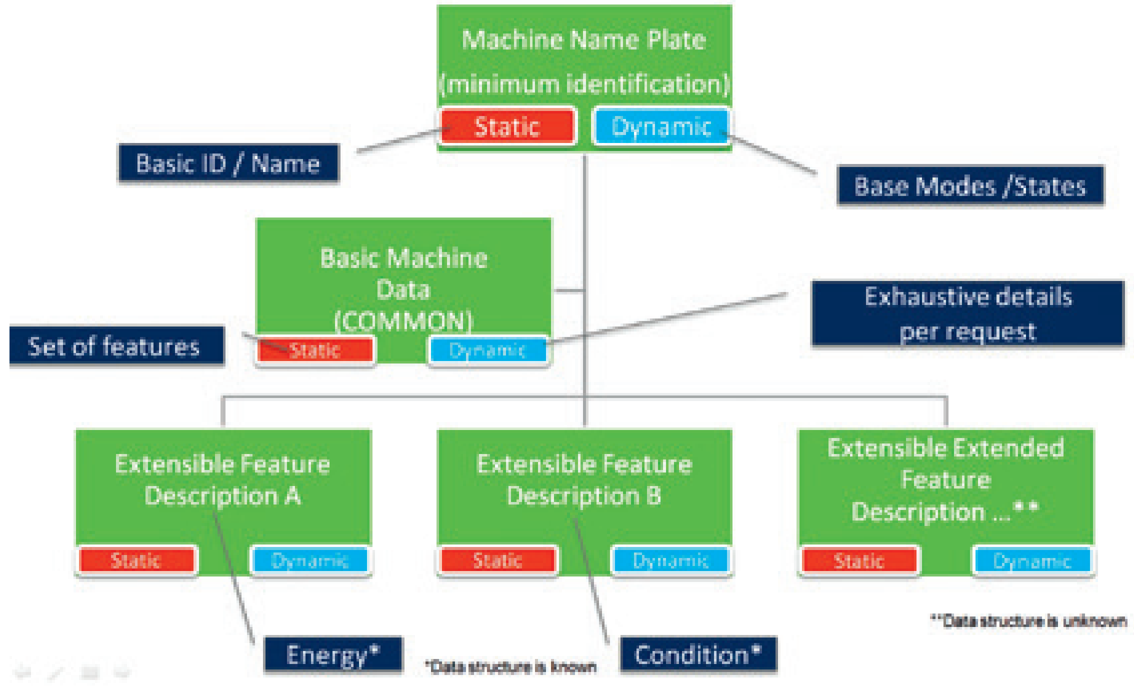
As part of the OMI initiative, ODVA's Machinery Information SIG has been working on a protocol-neutral data model for machine-to-supervisory system interaction (see picture 1). Picture 1 depicts machine-to-supervisory communication with machine data that is communicated to the MES layer following various paths using an OPC UA server over standard TCP/IP or a native industrial communication protocol like EtherNet/IP or Sercos® III. In this scenario, the external line controller can serve as a data aggregator to the MES layer while also leveraging the data for its own use. The line controller can either be a separate physical component in the architecture, as depicted in picture 1, or it may be an embedded function within one of the machine sections.

The machine model consists of a base machine object and additional (optional) objects. The optional objects can be predefined (e.g., as energy object and condition-monitoring object as depicted in picture 2) or can be independently defined.

The base machine object defines the unique machine identification, the set of features, and the basic state model. Optionally it contains an extended state model and more information about the production process.



Picture 1: Machine-to-supervisory communication with separate line controller

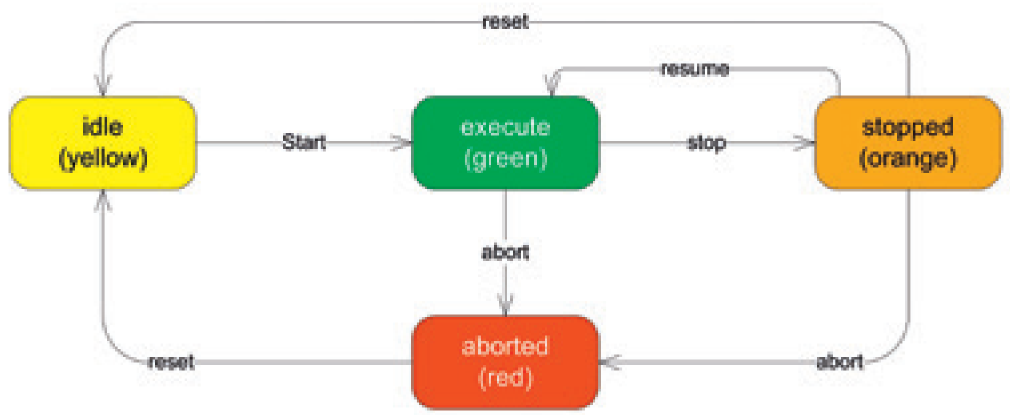


Picture 2: General machine information structure

The basic machine state model as shown in picture 3 consists of four machine states (idle, execute, stopped, aborted) and four basic colors have been selected to represent the states for status reporting.

The simple four color model unifies the reporting machine status corresponding to different existing industry standards such as PackML, Weihenstephan, GEM, MTConnect, and ANSI/ISA 88. Transient states are considered to belong to the preceding steady state for status reporting purposes.

To reach the goal of an interoperable communication framework, the defined data model will be mapped to CIP, Sercos, and OPC UA. By doing so, the machine supplier is given a common "socket" for which standard "plugs" will interface. The end-user benefits from a ubiquitous data model that easily traverses multiple protocols and networks.



Picture 3: Basic machine state model

This paper was presented at ODVA's 2015 Industry Conference & 17th Annual Meeting of Members in October 2015.

Consistent connection with Sercos and OPC UA industrial standards

As part of the fourth industrial revolution, IT and production technologies are merging with the objective of being an intelligent, self-organizing factory. The combination of OPC UA and Sercos is a promising solution. This combination enables transparent and consistent access to information relevant to process and production in cross-manufacturer semantics, including beyond-network boundaries, without having to sacrifice fast, secure and real-time-capable communication at the production machine level.

OPC UA as universal communication standard

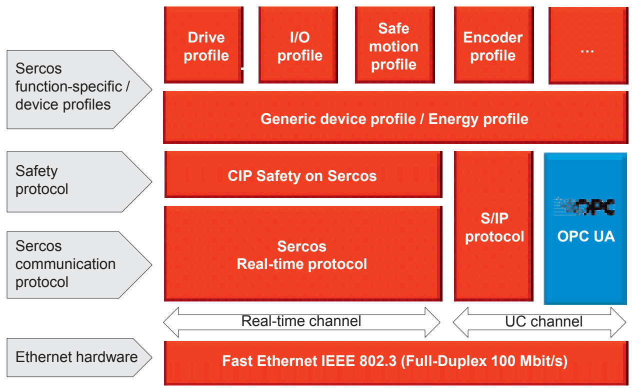
The OPC Unified Architecture (OPC UA) technology is a universal communication standard that makes it possible to connect systems from the corporate level down to the control or field level. OPC UA cannot only be integrated into devices on any platform with various programming languages, but systems of any degree of complexity can be fully described with OPC UA.

However, although OPC UA is in fact a communication standard that extends from the corporate level down to the field level, it has two key limitations. One is that OPC UA can use existing fieldbus and Industrial Ethernet systems only where there are no high time- and deterministic-communication requirements. The other limitation is that OPC UA only defines how data is described and exchanged. The actual meaning of the data (semantics) is not defined.

Therefore, combining the Sercos® real-time protocol and the profiles defined by Sercos with OPC UA and/or mapping them onto OPC UA is a promising approach. Thus, in a uniform and cross-manufacturer manner, process and device data defined in the Sercos specifications are made available not just locally via the Sercos real-time bus, but also via any superordinate network infrastructure via OPC UA.

High-performance real-time communication with Sercos

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 (picture 1). In the real-time channel, the collective telegrams specified by Sercos III are transmitted as a broadcast and



Picture 1: Positioning of OPC UA in the Sercos system architecture

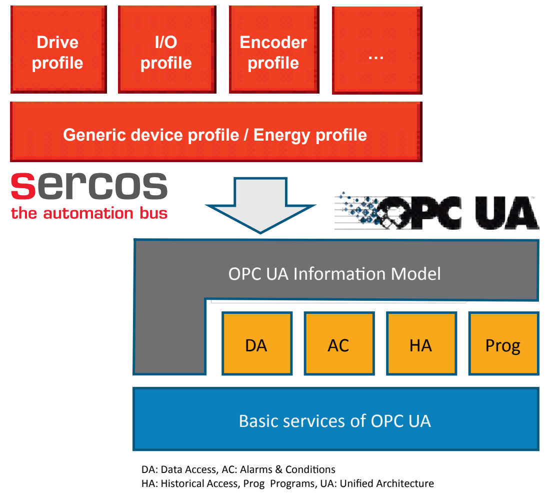
are processed on-the-fly by the Sercos III devices during the cycle. Additionally, in the Unified Communication Channel (UC Channel) any other Ethernet protocols can be transmitted, such as TCP/IP or EtherNet/IP, via the identical network infrastructure. In the process, communication cycles and the division of the 100 Mbit/s bandwidth into the real-time and UC Channels can be adjusted for each application.

The Sercos transmission process offers a number of advantages. Any Ethernet device can be connected to a Sercos network without additional hardware. Since tunneling of the protocols is not required, network users can communicate via any Ethernet protocol, even without continuous Sercos III real-time communication running. And since multiprotocol capability is ensured in parallel with continuous Sercos real-time communication, consistent data exchange is possible without negatively influencing the real-time characteristics of Sercos.

Since Sercos defines comprehensive function and device profiles for problem-free interplay between controls and peripheral devices (drives, I/Os, encoders, etc.), the exchanged data exists in cross-manufacturer semantics, regardless of whether that data is accessed via the Sercos real-time protocol or via other protocols, such as S/IP or OPC UA.

Combination of OPC UA and Sercos for continuous communication with cross-manufacturer semantics

The simple expandability via information models makes OPC UA highly interesting for a generic mapping of Sercos communication services and function and device profiles. The basic services of OPC UA can be mapped onto the basic services of Sercos (cyclical and acyclic data exchange). Furthermore, the data modeling on the basis of the Sercos parameters (IDN = Identification Numbers) can be mapped onto the OPC UA information model (picture 2).



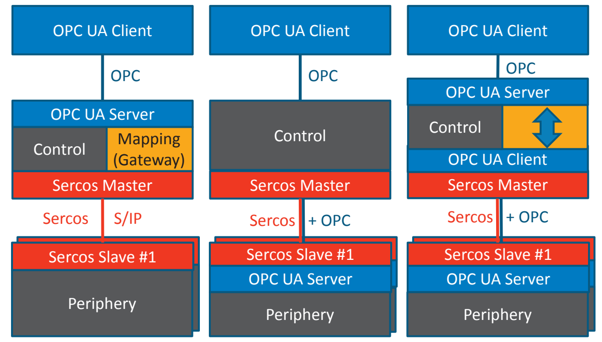
Picture 2: Mapping of the Sercos profiles onto OPC UA

With Sercos III, there are three different implementation options available for making the specific data of Sercos field devices available to superordinate factory levels via OPC UA.

One option is that the OPC UA server functionality can be integrated into a machine control where the control acts as a gateway in which the mapping onto Sercos services and data is implemented. Requirements of the OPC UA clients are converted into corresponding requirements of the control (Sercos master) and are communicated to the connected Sercos slave devices (picture 3, left). Moreover, the process data received by the control are made available to corresponding OPC UA clients using the OPC UA server. When continuous Sercos real-time communication is in operation, the data can be exchanged via the Sercos real-time channel and also the S/IP protocol in the UC Channel. If Sercos real-time communication has not yet been initialized, the S/IP protocol is available for the exchange of the data.

Thanks to the multiprotocol capability of Sercos described above, it is also possible to integrate an OPC server directly into a Sercos field device (drive, I/O station or sensor). In this case, the OPC protocol is routed through to the relevant Sercos slave device directly via the UC Channel described above. The gateway functionality of the control is thus reduced to the function of an Ethernet switch (picture 3, center). Due to the Sercos transmission process (no tunneling!), the ability of an OPC client and an OPC UA server to communicate with each other is preserved even when continuous Sercos real-time communication is not operational.

If the control wants to pass on the data of the connected field devices filtered or aggregated to the superimposed OPC UA clients, an OPC client can also be integrated into the control that makes the data collected via Sercos available to other OPC UA clients in edited form via an OPC UA server (picture 3, right).



Picture 3: Implementation options for coupling OPC UA with Sercos

Summary

With the mapping of the Sercos information model onto OPC UA, the functions and data made available by Sercos devices are also made accessible via OPC UA. Thus, not only is data exchange between the machine periphery and superordinate IT systems simplified, but the requirements of Industry 4.0 with respect to semantic interoperability are also supported.

The use of Sercos' multiprotocol capability is particularly interesting. This allows the OPC UA and Sercos protocols to be used in a common, uniform Ethernet infrastructure without impairing the real-time characteristics of Sercos in the process. Since protocols can coexist and are not tunneled in a Sercos network, consistent access to the machine periphery is possible even without continuous Sercos real-time communication operational.

Innovative control concepts because of cloud technology

When requirements such as higher scalability and fast system reconfiguration plus the rising complexity of algorithms become relevant, conventional controls for machines and systems reach their limits. New control concepts using modern cloud technologies promise to correct this.

Today, cost-efficient production in high-wage countries is possible only with a high level of automation. To this end, control systems of different types and from different manufacturers are used to automate machines and systems. These control systems make a very important contribution to efficient and high-quality production. The control systems were continuously developed in order to enhance productivity and manufacturing quality and for the purposes of controlling complex machines and processes. This has led to powerful but also highly complex control systems.

This entails advantages and disadvantages for users. On the one hand, with the available controls they can make use of high-tech machines and systems for their manufacturing and choose the system best suited to the application. At the same time, machine manufacturers can integrate their own process expertise into the controls in order to provide users with an optimal system that is tailored to their requirements. On the other hand, the operation of these machines represents a major challenge for users. While machine manufacturers often use control systems from a single manufacturer or a few manufacturers and have the necessary experts for these at the company, users' system operators must keep an entire machine fleet with various control systems from various control manufacturers in operation. If problems occur, they need experts for the different control systems or have to resort to the machine manufacturer's service technicians and thus accept high costs and possibly long downtime periods. Although it is possible to solve problems via telepresence portals, this does not always offer the necessary depth of intervention.

Another problematic point for users is the protection of process expertise. Today, anyone who has physical access to the control can easily download information from it. For example, often the control program is stored on SD cards that can easily be copied – no encoding or check for genuineness takes place. However, very high importance should be placed on the protection of process expertise, especially in times of industrial Trojans (such as Stuxnet).

In addition to these disadvantages in terms of service and administration, there is also the fact that today's control systems are not prepared for the flexible production of tomorrow. Hardware and software interfaces are difficult to upgrade and reconfigurability is possible only with major additional effort.

Furthermore, although the complete processing power of the machine control is hardly ever used today for simple applications, should complex controls, simulations or collision calculations take place in parallel to the machining process, the performance of a conventional machine control is not sufficient. Today, scalability of the available hardware resources is not possible without replacing the complete control.

Advantages and potential of cloud-based controls

As with conventional controls, the strict requirements of production technology such as real-time capability, availability and security must be able to be fulfilled by cloud-based controls. Therefore, due to the relocation of the control functionality to the cloud, there are a few challenges to meet, especially with regard to communication.

Particularly in flexible production, a cloud-based control will offer two crucial advantages over conventional solutions. For one thing, it is possible to scale the performance of the controls if requirements change. Processing power can be made available automatically, depending on the complexity of the algorithms and the control functions. Thus, with each automation system it is no longer necessary to provide oversized control hardware that is hardly ever used and is no longer sufficient in the event of new requirements. For another thing, a spatial change to the system arrangement will be easier to implement. To this end, a strict separation between hardware and software is necessary. In this way, higher availability can be ensured than with today's control platforms. Both advantages contribute to systems with controls in the cloud being significantly more future-proof.

Thanks to the relocation of the control functions to the cloud, one machine can interact more easily with other machines and can exchange information about services without hardware interfaces. It becomes possible to adapt the machine more quickly to changing external influences. Processes such as manual reconfiguration and the creation of new hardware connections become obsolete. Moreover, connection with mobile devices and interaction with the user can be implemented much more easily when parts of the control are performed in the cloud.

The same applies to the installation of more efficient algorithms (app concept), which optimize productivity. These, too, can easily be installed on existing machines by the control manufacturer if required. Furthermore, there will no longer be a need to have control hardware and the associated firmware available in order to simulate error cases at customers' premises. Control manufacturers can log directly into the original control and diagnose it.

Via a relocation to the cloud, the existing control technology can be opened out, modularized and – with mechanisms of cloud computing such as global data processing and service-oriented software architectures – expanded. A cloud-based control offers a suitable basis for connecting and providing processing power for future cyber-physical systems in production technology.

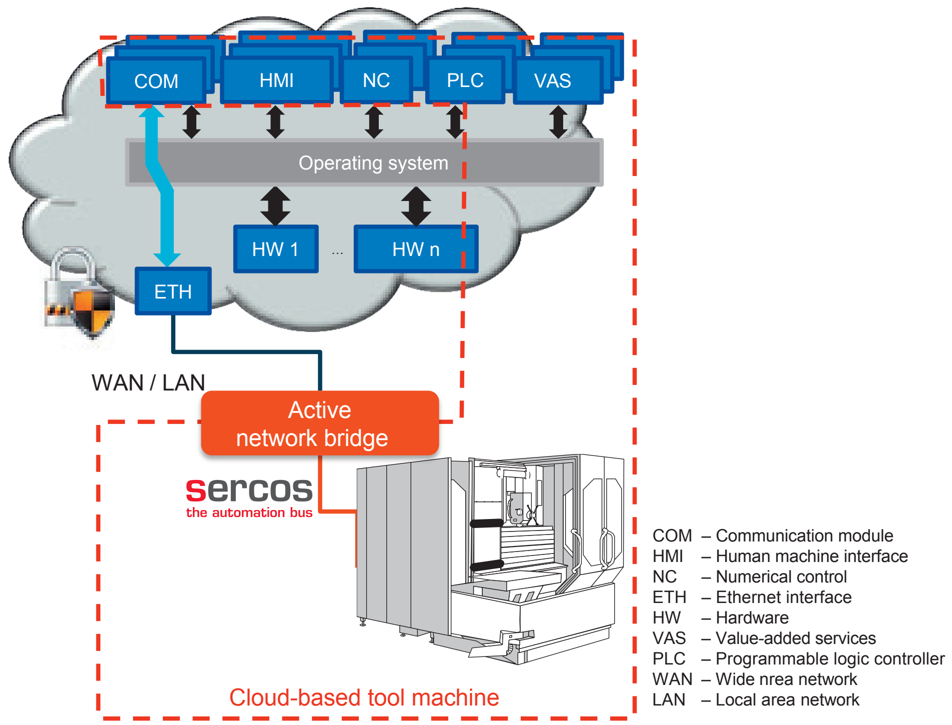
Cloud-based data management also offers other opportunities: for error diagnosis for example, for the purposes of improved manufacturer service. It is difficult to build up a sufficient database for condition monitoring in order to develop solutions in a targeted manner, especially with complex and expensive systems. With the relocation of the control to the cloud, all the necessary information of the machine is available, and the data of many machines can be merged.

In addition, in the cloud it is easy to produce a backup of the entire control to create a reserve system in the event of an error. A failover system and/or redundancies across several servers increase the availability of the machine.

Protection of the process parameters and the use of contemporary security mechanisms are made possible thanks to the cloud-based control. For example, only comparatively simple security mechanisms are transferred onto today's programmable logic control that cannot be replaced by computationally more intensive new processes.

Architecture of cloud-based controls

A cloud-based control implemented for a production system (e.g. a machine tool), results in the control architecture depicted in picture 1. The local actuator technology and sensors of the machine are connected to the cloud via an "active network bridge". This assumes the coupling of the non real-time wide area networks (WAN) and/or local area networks (LAN) with the real-time in the interior of the machine.



Picture 1: Control architecture of a cloud-based tool machine control

In the cloud, a variety of hardware is combined and made available via an operating system. Different instances of a control can be started; the hereby instantiated modules such as NC control, human-machine interface (HMI), programmable logic controller (PLC), interface for value-added services, and the communication module (COM) communicate with each other. If a module requires greater processing performance, that is provided dynamically by the operating system.

The biggest challenge in implementing cloud-based control technology lies in the provision of real-time capable communication between the control and the local machine. There are two possible approaches for meeting this challenge. A first possibility is to relocate the control technology with hard real-time requirements to edge clouds. Edge clouds are a part of the cloud that possess good communication links to the machine. This can also be cloud infrastructure in the company or even at the end of the production line. The local network (LAN) can then be equipped and configured accordingly in order to ensure real-time capability of the communication between the control and the machine. Another possibility is to increase the real-time capability of the communication networks. In standardization activities for Time-Sensitive Networking (TSN) currently being developed by the IEEE 802.1, the aim is to expand Ethernet with regard to a guaranteed lag and a guaranteed jitter, which are important in industrial communication.

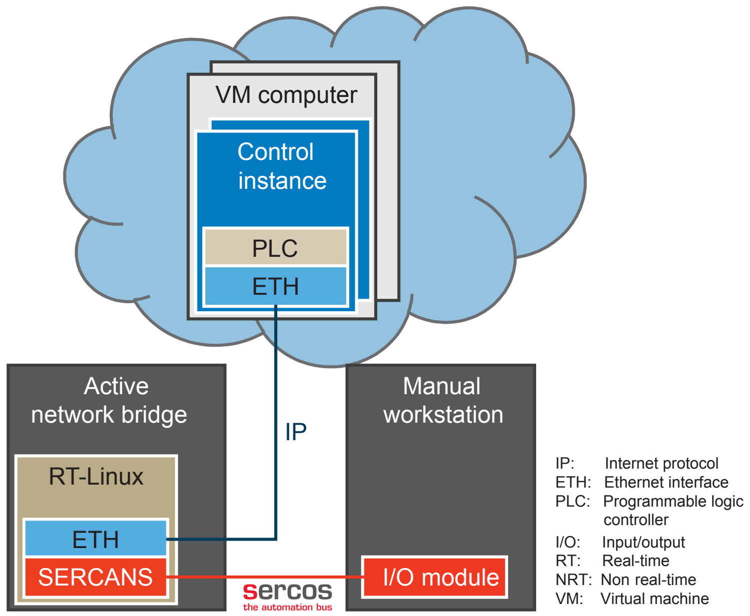
Demonstration of a cloud-based control

A cloud-based control was created for partly automated manual workstations in order to demonstrate the realizability of control technology from the cloud and the determination of initial results about the behavior of transmissions within a communication channel between cloud-based controls and systems. The complete architecture is presented in picture 2.

In the demonstrator, the manual workstation is controlled by a programmable logic control (PLC) instantiated in the cloud. The PLC communicates with the active network bridge via an Ethernet interface (ETH) and an IP-based protocol. The active network bridge is operated with the RT_Preempt real-time operating system in order to achieve as high-performing a connection as possible and couples the IP communication with the communication of the underlying fieldbus. Sercos® III is used as a fieldbus in the manual workstation. The type R-IL S3 BK DI8 DO4-PAC I/O modules of the manual workstation are connected via the Sercans III active master card (all Bosch Rexroth).

The performance of the development was evaluated in a local network. The average cycle time was configured to 10 ms. Here, it was shown that the cycle time is below 12 ms in almost all cases. To determine the performance via the Internet between the University of Stuttgart and the Google Cloud Center in Europe in another application, an average round trip time of less than 43 ms was achieved. Measurements between the University of Stuttgart and a server installed in the area around Stuttgart, which was connected via a DSL connection, are also on this scale. The maximum times were 150 ms. These times are within acceptable limits for partly automated manual workstations since they do not lead to waiting times in manufacturing or impact the process result.

Partial results of this article came into being as part of the project "pICASSO (Industrial Cloud-based Control Platform for Production with Cyber-physical Systems)", which is sponsored by the German Federal Ministry of Education and Research.



Picture 2: Complete architecture of a partly automated manual workstation

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Significantly increasing productivity

Automation technology in the 21st century offers perfection in speed, precision and quality – and is flexible, smart and intuitive, too. In addition to pneumatic automation technology, applications with electric automation technology, and above all those featuring customer-specific combinations of the two technologies, are bringing the automation of the future into new dimensions of productivity.

Festo research projects, such as the Bionic Learning Network, Industry 4.0, or the industrial use of superconductors, will allow completely new applications for the contactless transport of workpieces within self-learning, self-adapting and totally flexible systems. Let's point out three enablers of productivity increase and three Industry 4.0 hotspots:

IE and Industry 4.0

Even today, Festo is a market leader in networked and intelligent components and system solutions which make it an enabler of productivity. Only with sophisticated automation solutions will it be possible to meet the challenges of the future such as the desire for individualized and personalized products, the diversification and atomization of markets, rising energy costs and the enormous pressure on costs resulting from globalization and continuous technological change.

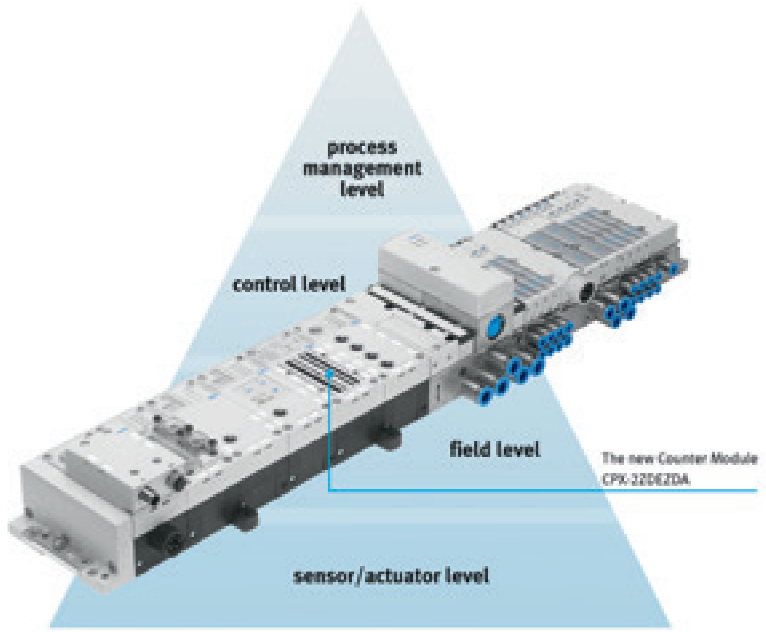
As a global player, Festo supports various Industrial Ethernet protocols as well as the established fieldbus protocols. But they hope to see a more harmonized standard like OPC UA as part of the Industry 4.0 discussion and standardization processes. I/O link and AS-Interface support on the sensor-actuator level.

CPX terminal goes Industry 4.0

With it's latest update, the famous CPX remote I/O terminal from Festo features an optional CODESYS controller on version 3, which gives the terminal a full 3-D motion control including CNC editor for small applications, plus an Industry 4.0 connection via an OPC UA client-server integration. All six major Industrial Ethernet protocols received major updates (Sercos® III, Profinet, EtherNet/IP, Ethercat, Powerlink and Modbus/TCP).

Multicarrier system for Industry 4.0

The new multicarrier system makes your production processes significantly more flexible. This configurable transport system can be freely integrated into your existing intralogistics and precisely synchronized with the process. It supplements traditional materials handling solutions exactly where it is needed in the process. The other conveyors stay unchanged. The integrated control concept allows control of the transport motions and motion control functions and the coordination of additional machine modules. The result is maximum machine flexibility. Industry 4.0 connection is also an option via an OPC UA client-server integration.



Productivity increase: Electric automation as a core business

Festo is constantly making life easier for users with regard to electric automation. In addition to pneumatics, Festo is also continuously expanding its portfolio of electric axes, motors and controllers. Software allows electric actuators to be configured quickly and easily. Festo's automation platform CPX provides a simple means of networking several levels of the automation pyramid.

Customers' design engineers can draw on the extensive Festo product portfolio, including mechanical drive components, motors, axis controllers and firmware, as well as diagnostic and operating equipment for motion control systems or their PLC. There is a wide range of toothed belts, spindles, recirculating ball bearing guides, and linear motor axes available in the case of electric drives. The multicarrier system is one of the latest highlights. Everything comes from a single source and is perfectly coordinated. This means there are no interface problems.

Productivity increase: Ready-to-install robotics and Handling Guide online (HGO)

In recent years, Festo has surprised the automation market with groundbreaking ready-to-install innovations for handling and assembly operations based on electric drive technology. This include the delta robot EXPT, the high-speed H-gantry EXCH, the high-speed T-gantry EXCT and the mini H-gantry EXCM. A common feature of all of Festo's ready-to-install handling solutions is their highly dynamic operation thanks to low moving masses, and the fact that the solutions are built using standard Festo components. A modular axis system allows customers to configure and order their systems – including IE integration.

Driven by you

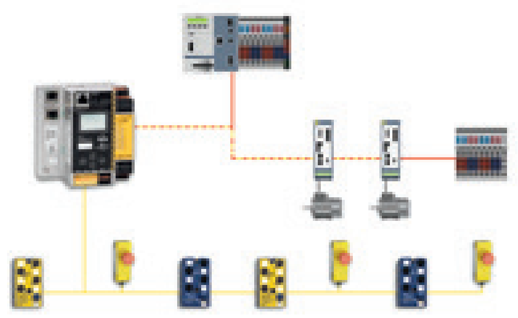
That AS-Interface is perfectly suited for interacting with virtually every available automation system has long been known. Now this passionate team player is entering new realms: With the new AS-i Safety Gateway BWU3160 from Bihl+Wiedemann drives can be safely controlled and monitored using CIP Safety on Sercos – directly and without an additional safety PLC.

Competitors and partners? At first glance it may seem like a classic case of either-or, but on closer inspection we see clear possibilities for a both-and. Especially in Germany cooperation between competitors has a long tradition: As early as 1890 for example machine builders came together in the Verein Rheinisch-Westfälischer Maschinenbauanstalten, followed two years later by the Verein Deutscher Maschinenbau-Anstalten, predecessor of today's VDMA.

Even more concrete is the cooperation among companies in the various user organizations in the field of automation technology: Here, all the members combine their expertise to develop a common system, after which they will enter the market as competitors with their own products derived from this cooperation. At the end of the day there are only winners: The member companies because most of them could not alone have supported the basic research, but above all the customers, who benefit from the efficient solutions that could not be offered without the cooperation of their suppliers.

All this is of course no big surprise in the relevant industries. Less well known may be the fact that the mingling of automation specialists works supremely well not only on the level of the respective umbrella organizations, but also in very specific individual cases. "When the customer actively demands something, we are always able to solve special tasks together with other companies," says Bihl+Wiedemann CEO Jochen Bihl. "This means I can only encourage users and machine builders to proactively formulate their wishes and thereby stimulate their suppliers to further optimize cooperation with the products used in the machines."

One current example is the latest AS-i Safety Gateway BWU3160 from Bihl+Wiedemann, which offers completely new possibilities for machine communication with drives: With the help of CIP Safety on Sercos® this device can safely control Bosch Rexroth drives directly, and without a need for the previously required safety PLC. In the standard area the drives continue to be directed by the usual controller. But the Gateway takes over the safety part, selecting safe



AS-i Safety Gateway used as a CIP Safety Originator in the Sercos network without an additional safety controller. This allows the advantages of AS-i and AS-i Safety to be exploited in parallel on the lowest field level.

functions in the drive and shutting it down safely when necessary.

The impetus for developing this product came from customers. They wanted to combine the advantages of both worlds – the amazingly simple safety technology of AS-i Safety and the globally recognized drive technology of Bosch Rexroth – in the most cost-effective way possible. From then on things moved rather quickly. Both manufacturers simply put their heads together and searched for a common solution to the challenge. Simply? "I must admit: solving this task was a difficult bit of work," Jochen Bihl allows. "But it was absolutely worthwhile."

The product that resulted can be called a real all-rounder. The new AS-i Safety Gateway for CIP Safety combines two AS-i Masters for two AS-i networks. This provides up to 62 two-channel safe inputs, with three additional ones integrated directly in the device. Six fast electronic safe outputs directly in the unit ensure that the technological bridge from AS-Interface to CIP Safety is appropriate to high-performance drive technology. And using Safe Link, the safe coupling from Bihl+Wiedemann, the Gateway can be expanded to nearly 2,000 safe in- and outputs – at no extra cost, by the way.

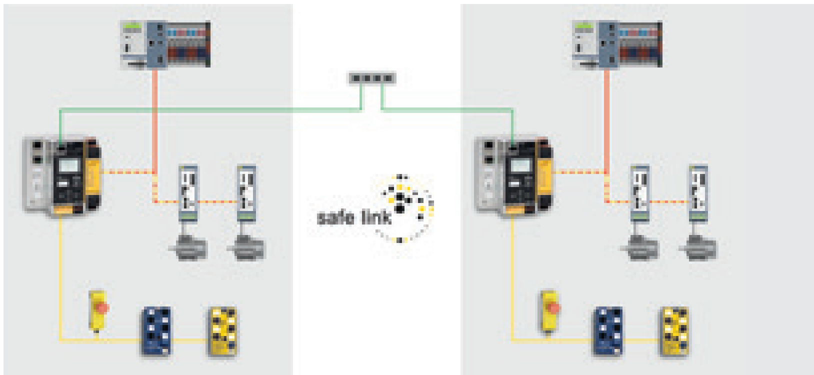
CIP Safety on Sercos also reduces wiring effort and expense: There is just a single cable – the Sercos cable. This carries both the standard and safety data. Drives with integrated safety technology are connected exclusively using this Sercos cable. Additional cables, for example to stop the drive safely, are not needed.

Need short response times? Voilà: Communication on Sercos is fast, the safety program is processed directly in the Gateway and communicates with the safe drives without any detours. This also makes programming simple and clear. The new Gateway can be used as a so-called CIP Safety Originator without an additional host controller – with the positive side effect that the financial outlay is simultaneously reduced by a significant amount.

Sercos users profit doubly with the AS-i Safety Gateways from Bihl+Wiedemann. On the one hand, safe drives are monitored in the simplest and most cost-effective way, while, on the other hand, all the benefits of AS-Interface in networking simple sensors and actuators can be enjoyed – in other words, all the strengths which AS-i has made as virtually the de facto standard throughout the world in just a short time.

For Bihl+Wiedemann this innovation is a completion of their own product range designed for safe speed monitoring. Given the rapidly increasing emphasis placed on this topic, the safety specialists in the company have in recent years been working intensely on the development of especially efficient solutions: speed monitors for sensors and for encoders as well as speed monitoring in the Gateway, in the module or directly in the drive. "In the meantime," notes co-founder and CEO Bernhard Wiedemann, "our portfolio is complete to the point where we have the right concept ready for virtually any application."

For AS-Interface this innovation means perhaps even more – a kind of quantum leap. For the new Gateway is essentially the first AS-i component that functions not just as the safety boss for sensors and actuators and as data provider for a fieldbus of higher order, but also acts as a safety PLC to independently take on control tasks in the area of drive technology.



Using Safe Link, the safe coupling over standard Ethernet from Bihl+Wiedemann, multiple drives can now be safely monitored and controlled with CIP Safety on Sercos – even when they are installed in different machines or system parts.

ABB Switzerland Ltd.

ABB

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Pluto Sercos III Gateway

Pluto Sercos III Gateway is a compact and fast unit providing two-way communication for Pluto Safety PLC over the Industrial Ethernet protocol Sercos® III.

The 22 mm wide unit is DIN rail mounted, and can be connected anywhere on a Pluto safety bus. The unit has a common interface with Pluto, i.e. the same cabling, and the Pluto Manager PC program can be used for servicing and configuration.

When programming Pluto there are ready-made function blocks for gateway communication with non-safe systems. Via the Sercos III protocol a non-safe PLC system can have access to the I/Os and other variables in a Pluto safety PLC. Global I/Os in a Pluto safety PLC are accessible via the usual I/O transfer in the protocol.

Local data in Pluto units can be transmitted by function blocks in Pluto called "Additional data". Function blocks for receiving data are available in Pluto Manager. A total of 16 byte data can be transmitted, 64 boolean variables/ 8 registers or a combination of them.

Automata GmbH & Co. KG

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Sercos slave & Ethercat master

The S3ECm variant of the Sercos®-/Ethercat®-Bridge enables direct communication of control systems with integrated Sercos master and Ethercat slaves.

The Ethercat master is located on the S3ECm module and takes care of data exchange between the two busses.

On the Sercos bus the S3ECm module acts as an I/O device with FSP-I/O profile. The engineering tool uses the device description file (SDDML file) to integrate it into the bus topology. Number and characteristics of the connected Ethercat slaves are described in a configuration file (ENI file) generated by an engineering tool from the device descriptions of the connected slaves (ESI files). The upload of the ENI file to the S3ECm module can either be done directly from the Sercos master via UCC or over the additionally available standard Ethernet port. In both case TFTP protocol is used.

The bidirectional transmission of real-time data between Sercos master and Ethercat slaves is consistent and synchronized. The shortest cycle time of the module at the Sercos bus is 250 µs, for high-speed applications more than enough. Real-time operation mode of the Ethercat bus starts automatically. On demand, it can also be controlled by the application running on the Sercos master. The real-time data transmitted by the S3ECm module to the Sercos master contains extensive diagnostic data and status information about the Ethercat side and enables thus a safe and stable communication with the connected Ethercat slaves.

Bosch Rexroth AG

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Frequency converter EFC 3610 & EFC 5610

The frequency converter 3610 with V/f control and the frequency converter 5610 with SVC, both in the power range from 0.4 kW up to 90 kW, are practical, flexible, compact, and complete.

- Space-saving installation and wiring with top hat rail (up to 7.5 kW) and I/O plug terminals, as well as numerous option modules – so installation and integration couldn't be simpler
- Removable operating unit with accumulator function, optional LCD plain text display, simple parameterization using autotuning, copy function or USB port – for quick, reliable series-production commissioning
- Configurable and extendable using I/O or fieldbus modules (Sercos® and Multi-Ethernet, Modbus on board, Profibus and CANopen as option) – for universal use and the simple extending of functions

HydraulicDriveController VT-HPC

The simple, open and scalable digital pump controller VT-HPC for the modern automation of hydraulic drives offers best-in-class pump controller and optionally a programming language according to IEC 61131-3. Available for Sercos® and Multi-Ethernet and various fieldbusses, offering a variety of service and diagnostic utilities.

The HPC has been designed for use in tough industrial environments and features high-level interference immunity, as well as high resistance to mechanical vibrations, shocks, and climatic conditions.

- Scalable in software
- Swivel angle control
- Pressure control
- Torque limitation
- Minimal cycle time of 0.5 ms

PRC7x00 – controller for resistance spot welding

By means of adaptive control algorithms, the new Rexroth welding control PRC7000 is optimally prepared to provide repeatable high welding spot quality. The welding of different combinations of sheet thicknesses and materials such as steel and aluminum is possible. With the precise adjustment of the welding current, spatter and expensive reworking can be avoided. Even today, handling, processing control, and monitoring functionalities are ready for future requirements of welding processes.

- Efficient handling and diagnostics with PRI7000 software
- Integrated web server facilitates operation and diagnostics via smart devices
- Optimized programming, control, and monitoring functionalities for maximum welding spot quality
- State-of-the-art performance electronics for maximum energy efficiency
- Open system architecture with integrated application layer and servo-gun functionality

JVL Industri Elektronik A/S

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The MAC series: Integrated servomotors – all in one

The MAC series – the complete solution of efficient and compact servomotors with integrated controller, PLC system, driver and Sercos® III interface.

The series is ranging from 50 W to 3,000 W, 0.11 Nm to 9.0 Nm. The MAC motors minimize installation costs and space requirements and protect against electrical noise. All JVL servomotors can be equipped with Sercos III and easily be set up from either the JVL configuration tool MacTalk or from Sercos III directly. All motors can be optionally equipped with a built-in brake or higher IP protection class. The motors in the range 400 W to 3,000 W offer safe torque off as an additional feature, ensuring a safe way of removing the torque from the shaft without removing the power supply to the motor. Additionally, they optionally offer built-in absolute multiturn encoder.

The MIS motor – integrated stepper motors

Stepper motor with integrated controller and Sercos® III interface. All necessary components in one unit.

JVL offers fully integrated stepper motors with Sercos III in sizes of 3 to 25 Nm, NEMA34 to NEMA43. The basic idea behind the MIS motors is to minimize installation costs and also have a component that is much better protected against electrical noise, which can be a typical problem when using long cables between controller and motor. The stepper motor, hall sensor or encoder and electronics are specially developed by JVL, so that they form a closed unit, where power driver and controller are mounted inside the motor in a closed section.

All MIS motors have a built-in optional magnetic absolute encoder, whereas MIS34x and MIS43 have a built-in optional absolute multiturn encoder.

Lenord, Bauer & Co. GmbH

Dohlenstr. 32 | 46145 Oberhausen | Germany
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PowerDRIVE positioning with integrated Sercos III interface

In addition to the PowerDRIVE box with Sercos III module, the PowerDRIVEs GEL 6110 are now available with integrated Sercos® III interfaces. The complete product range GEL 6110 up to 10 Nm nominal torque in aluminum or stainless steel housings supports Sercos III.

The PowerDRIVEs combine various function units such as gears, BLDC motors, electronic commutation, brake operation, multiturn sensor, etc. in a compact housing. The Sercos I/O profile is used to implement these combined positioning drives in a plant control system. The proven function blocks from Lenord + Bauer also aid commissioning here.

Optimize your plants using our PowerDRIVEs with integrated Sercos III interface or select our PowerDRIVE system with Sercos module.

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Servo drive C1450-SC

Industrial linear motors and servo controlls for highly dynamic positioning tasks and as a replacement for pneumatic cylinders.

- 1 x 240 VAC/15 Arms phase peak current
- Controls LinMot linear motors and AC servomotors
- Interface for optional incremental or absolute sensor
- Configuration interface RS232
- 4 digital inputs
- 2 digital outputs
- 1 analog input single ended 0..10 V
- 1 analog input differential ±10 V

SPS IPC Drives 2015

Leaders from various industries received latest information on Sercos at SPS IPC Drives in Nuremberg, Germany.

Sercos International recorded high visitor interest during the recent SPS IPC Drives show in Nuremberg, Germany.

The new Sercos® SoftMaster demo, which offers high speed and hard real-time using a standard Ethernet controller, attracted the most attention.

ISG – Industrielle Steuerungstechnik GmbH – a leading supplier of soft CNC, motion, and robotics solutions, demonstrated a PC-based pick & place robotics application that implemeted the new Sercos SoftMaster from Bosch Rexroth on a Tenasys "Intime for Windows" RTOS platform. Motion programming is done via PLCopen-based function blocks using the Multiprog SoftPLC programming environment.

ke Next magazine included the Sercos SoftMaster as part of its German-language exhibition check video. A similar English video from Tenasys is also available.

Another highlight was the Sercos-based vision system from Imago Technologies. Numerous new products were displayed; among them drives and controls from Bosch Rexroth; a Sercos slave and Ethercat master in a single device from Cannon-Automata (the new version of the S3EC Sercos/Ethercat bridge); the Inveor drive control from Kostal; and a device that serves to control sensors and actuators on the robot arm for the exchangeable tools of packaging machines from Schubert System Elektronik.

"SPS IPC Drives was a full success. With the provision of a Sercos III SoftMaster implementation as an open source, it becomes much, much easier for manufacturers to develop a Sercos III master and at the same time to participate in future improvements and expansions of the software," said Ilona Arnold, Marketing Manager of Sercos International. "In this way, control systems can be designed more affordably and will be simpler and more compact in the future. This is a very important criterion."

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Publisher
Sercos International e. V.
Kueblerstrasse 1
73079 Suessen
Germany

: +49 (0)7162 9468-65
: +49 (0)7162 9468-66
info@sercos.de
www.sercos.org

Editing and Design
MILANO medien GmbH
Hanauer Landstrasse 196A
60314 Frankfurt am Main
Germany

: +49 (0)69 4800054-0
: +49 (0)69 4800054-9
info@milanomedien.com
www.milanomedien.com

Sercos 2015 highlights

In 2015, Sercos International celebrated its 25th anniversary as a user organization and the 10th anniversary of the Sercos III technology. Much has happened in these years that contributed to Sercos' development from a digital drive interface towards a high-performance and universally usable automation bus.

Last year, Sercos announced the release of the OPC UA Companion Specification for Sercos® that describes the mapping of the Sercos information model to OPC UA, so that functions and data of Sercos devices are made available and accessible via OPC UA. This initiative aims at simplifying the communication between machine periphery and supervisory IT systems, supporting the requirements of Industry 4.0 regarding semantic interoperability.

Sercos also announced the availability of the Sercos III IP core for Xilinx 7 series FPGAs and devices of the Zynq SoC family. The IP core is available for Sercos III master and slave controllers (SERCON100M/S) for automation devices. It includes hardware functions, such as timing, synchronization and processing of cyclic and acyclic data on the basis of two integrated Ethernet MACs. Sercos III master and slave devices can be implemented as a single-chip solution using Xilinx Artix®-7 FPGAs, other FPGAs of the 7 series or Zynq SoC devices, which integrate an ARM® dual-core Cortex™-A9 processor.

Another highlight was the availability of a Sercos III SoftMaster implementation as open source software. It will now become much easier for vendors to develop a Sercos III master and also benefit from optimizations and additions to the software. Thus, control systems can be designed much easier, more compactly and at competitive prices.

Sercos also exceeded 5 million real-time nodes installed worldwide and established a working group to evaluate Ethernet TSN and it's usability for fast, real-time machine communication.

Exhibitions, conferences, seminars, and a forum acted as media to spread the Sercos information and also acted as a platform for the exchange of trends and developments. Various optimizations in communication took place by launching the Japanese website and the worldwide member portal.

Last but not least, a great number of new products in various categories added to the growth of Sercos-capable products.