



plug and play – sercos, the automation bus



sercos – one of the leading bus systems in the industry for over 20 years. Real-time technology tried and tested a million times over, universal application options and long-term reliability make the Ethernet system the first choice in engineering and construction. sercos, the automation bus.

The basis for its success in all kinds of industries and applications lies in its efficient and deterministic communication protocol, which uses an optical transfer system that is immune to electrical and magnetic fields, as well as ground loops. sercos has reached worldwide acceptance in all large automation markets as the de facto standard for demanding applications with high requirements for dynamics and precision. sercos not only specifies a real time communication system, but also more than 500 standardized parameters, which define the interaction of controls and drives in cross-manufacturer semantics. This is the basis for interoperability of devices from different manufacturers. Over 3 million real-time nodes are already in use today.

sercos III – universal communication for all applications

The vision of a real-time, non-proprietary communication solution permeates the world of industrial automation. Different types of automation devices have to be network-enabled in an easy and integrated way. sercos III, the open, IEC-compliant universal bus for Ethernet-based real-time communication, already delivers the functionality you need.

sercos III is the third-generation, nonproprietary sercos interface bus system (IEC 61491), which offers you a number of advantages:

- Universal bus for the entire spectrum of industrial automation applications
- Standardized solution defined in IEC 61158, 61784, and 61800-7
- Flexible, inexpensive, and integrated thanks to the use of Ethernet technology

- Utilization and consistent further development of the proven sercos drive profile in use for over 20 years
- Utilization and innovative further development of proven real-time communication methods
- Integrated and uniform device profile with the highest degree of standardization, resulting in simple engineering and maintenance

What has been retained?

- Proven features such as topology, profiles, message structures and synchronization have been retained.
- Existing sercos implementations and applications can be simply transferred to sercos III.

What are the advantages of sercos III?



sercos III is the logical next step in the evolutionary development of the sercos technology. Besides its low costs and excellent performance, sercos III also specifies numerous new functions that are trend-setting in automation technology.

What is new?

- Standard Ethernet is used as the physical layer and protocol
- Faster due to higher bandwidth and shorter cycle times
- More synchronous due to a highlyprecise synchronization procedure with run-time compensation
- More universal due to a new communication mechanism, as well as new and expanded device profiles
- New, innovative communication functions, e.g. direct cross communication and integrated standard Ethernet communication
- Fast medium redundancy in communication, resulting in improved machine availability
- Simple implementation

Versatile

- All automation devices, such as controllers, servo drives and I/O periphery, communicate via a uniform Ethernet-based network for automation technology.
- Safe and non-safe participants can coexist in one network without influencing the security technology.
- All Ethernet-based protocols can be transmitted at the same time as real-time data without influencing the real-time characteristics.

Fast and direct

- High speed: sercos III uses the speed of Fast Ethernet (100 Mbit/s).
- Short runtimes: The runtimes through the network are reduced to a minimum. This is achieved by:
 - Extremely fast processing of the sercos III real-time messages when passing through the devices ("on-the-fly")

- No additional network components, e.g. hubs or switches
- Direct cross communication: all nodes can exchange data directly – with minimal idle time within one communication cycle.

Efficient

- Efficient usage of bandwidth: ideal utilization of bandwidth possible by means of multiplexing techniques
- Arbitrary cycle time: The communication cycle can be varied between 31.25 µs and 65 ms.

Synchronous

• Synchronicity down to a fraction of a microsecond

Integrated

• All office communication protocols (e.g. TCP/IP, UDP/IP) can be transmitted parallel to sercos III real-time communication via the same cable.





The advantages

- Synchronization and redundancy are not mutually exclusive.
- Standard Ethernet protocols use the MAC or IP addresses to communicate with individual sercos III devices. Tunneling of these protocols is not necessary.
- Commissioning and diagnosis of sercos III devices via standardized interfaces (SCI, S/IP, and FDT/DTM)

Safe

- Safety functions up to SIL3 according to IEC 61508 can be implemented with CIP Safety on sercos.
- The routing capability of CIP Safety supports safe device communication across network boundaries.
- A safety network can stretch across diverse CIP Safety networks, includ-

sercos interface milestones

1985	WZM interface working group (in cooperation with ZVEI and VDW)
1987	Establishment of the "Digital Drive Interface" working grou
1989	Presentation of the sercos interface at the European Machine Tool Show (EMO) in Hanover
1990	Establishment of the sercos interface user group (FGS)
1993	Availability of SERCON410B Asic (sercos I)
1994	Establishment of sercos North America (sercos N.A.)
1995	sercos interface is approved as the international standard IEC61491
1998	Establishment of sercos Japan
2000	New test lab at the University of Stuttgart
2001	Availability of SERCON816 Asic (sercos II)
2003	Start of development of sercos III based on industrial Ethernet
2005	Presentation of the first sercos III products and applications
2006	Safety Concept CIP Safety on sercos
2007	Approval of sercos III as the international standard IEC 61158/61784
2010	25 years of sercos

ing, for example, Ethernet/IP, DeviceNet and sercos III.

High availability

- For high-availability automation solutions, sercos III automatically offers fail-safe communication in the case of a cable break or node failure through the use of a ring topology (ring redundancy).
- The time needed to detect and respond to a cable break is a maximum of 25 µs, so at most only the data from one cycle is lost and communication is continued afterwards.
- If a redundancy situation occurs, the synchronization quality is main-tained.

Flexible

- Centralized and decentralized control architectures are supported.
- User-defined device configuration within the network.
- Support of ring or line topologies. In addition, hierarchical, synchronized and real-time coupled network structures can be implemented.
- Hot-plugging is supported without interference with real-time or syn-chronization functions.





Easy

- sercos III devices can be easily configured and commissioned by means of a uniform, integrated device model and universal, standardized device profiles.
- The protocol automatically detects the device and where it is connected in the topology. This makes it easy to localize the affected device for servicing.
- Easy wiring, as the physical order of the devices is not relevant and the order of connection of the two sercos III ports is not important.

Cost-effective

- Use of standard components allows for cost-effective implementation of hardware. Additional active network devices, e.g. switches or hubs, are not required.
- Master connectivity can be implemented in the hardware, hardware and software, or just the software.
- Slave connectivity is based on costefficient and flexible FPGA devices or integrated multi-protocol chips.

Standardized

- sercos has been an approved international standard for real-time communication since 1995 (IEC 61491).
- The real-time Ethernet protocol sercos III is part of IEC 61158 and IEC 61784. The device profile for drive communication is included in IEC 61800-7.
- Experts from the sercos working groups contribute to national and international standardization committees.

Future-proof

- sercos is an open, international standard.
- The specifications are maintained and further developed by experts in non-proprietary working groups.
- Good investment protection is provided by backwards compatibility.
- The technology is continuously developed and adapted to new market requirements.



"First CNC, then demanding motion control, and now general automation: sercos III has all the advantages of standardized, proven real-time mechanisms with Ethernet and fulfills these requirements extremely efficiently."

Dr. Bernd-Josef Schäfer, CEO of sercos international

Non-proprietary

- sercos is a non-proprietary technology.
- The specifications are disclosed completely.
- sercos technology is owned by the sercos international e.V. user organization.
- Membership in the user organization is not required in order to use the sercos technology.

Proven

- Products from leading automation manufacturers support sercos.
- sercos is widely accepted in many different industries, particularly with regard to demanding applications.
- Over 3 million sercos real-time nodes are used worldwide in more than 350,000 applications (and growing).

Why Ethernet?

The increasing number of control components, actuators and sensors in industrial automation adds to the complexity of control networks. The future of industrial communication lies in cost-effective integration of these automation components in low-cost Ethernet networks, which have been engineered to suit the needs of industrial automation.

Specialized field bus systems were used for simplified networking prior to using Ethernet in automation technology. Fast Ethernet technology replaces these systems and offers a number of advantages:

- Recognized, future-proof technology
- Data throughput 10 to 100 times faster than field bus solutions
- No need for expensive, proprietary hardware
- Use of standard components, e.g. CAT5e copper cable with double shielding; connectors and controllers produced in large volumes
- Consistent IT implementations stretching from the office to the field level
- Flexible, compatible automation systems based on a global standard
- Supports worldwide networking for diagnostics and maintenance

Ethernet technology combines the peripheral, drive, safety functionality and office communication in a common medium, providing a simple, cost-effective, and powerful solution.

Ethernet – consistent from the office to the field level



How does sercos III function?

The solution is very simple and efficient: sercos III merges proven real-time mechanisms with the Ethernet physical layer and protocol. A collision-free real-time channel with improved protocol efficiency transmits the messages defined by sercos.

Independent of this collision-free, realtime channel, a parallel channel (time slot) can carry all other Ethernet messages and IP-based protocols such as TCP/IP and UDP/IP. Cycle times and the division of the real-time and non-real-time channels can be adapted to the specific application.

sercos III communication is based on standardized parameters to control device functions. There are no hardware or manufacturer dependencies. When the network is initialized, the parameters which make up the real-time data set on the device channel are defined in the configuration.

sercos III is a universal bus for automation technology which offers communication channels and device profiles for all standard automation applications:

Real-time communication channel

- M/S (master/slave): exchange of functional data between master and slave in an M/S connection
- CC (cross communication): direct peer-to-peer communication between devices in a CC connection, either between controllers or between drive and peripheral slaves
- SVC (service-channel): service data exchange on an SVC channel as a part of real-time communication
- SMP (sercos messaging protocol): transmission of functional data for several devices in a time slot by means of a multiplex technique, configured in an M/S or CC connection
- sercos safety: exchange of safetyrelated data in an M/S or CC connection, e.g. shut-down signals, enable signals or safe set points



"Almost 10 years of positive experience with sercos controls and drives are why we decided to use sercos III as the system bus in our machines and systems. Thanks to the real-time performance of sercos III for motion and I/O, as well as an option to easily integrate TCP/IP services, we expect that future developments will produce essential added-value for our production machines."

Eduard Ams, Manz AG, Division Manager R&D Basic Technology

NRT communication channel

- Standard Ethernet: connectivity to any non-real-time Ethernet device such as a notebook PC for engineering or a webcam
- Other Ethernet protocols: transmission of any Ethernet-based protocols in the NRT channel

Device profiles

• Drive profile: uniform and integrated functions for actuating hydraulic, pneumatic, and electrical drives

- I/O profile: uniform and integrated functions for actuating modular and non-modular I/O stations
- Encoder profile: uniform and integrated functions for actuating encoders
- Generic device profile: uniform and integrated functions for controlling the administration functions in all types of devices

Energy profile

Uniform and integrated functions for low-energy operation of the machines and systems used with sercos III



sercos III real-time communication with standardized parameters

The sercos III protocol – the DNA for your industrial communication

sercos III offers a powerful protocol to meet the needs of today's industrial automation solutions. It combines the advantages of the non-proprietary Ethernet standard with the real-time precision of industrial automation technology.

Open sercos III communication cycle



sercos III uses IEEE 802.3 compliant Ethernet protocol type 0x88CD to send data in cyclic messages (telegrams), which provide the M/S, CC, SVC, SMP and Safety communication mechanisms. The exchanged data can be addressed via standardized parameter numbers from the drive, I/O, encoder, and generic device profiles.

The telegram types are listed below:

- Master Data Telegram (MDT): The master sends command data to the slaves.
- Acknowledge Telegram (AT): The slaves send status data back to the master and to other slave devices.

The attached devices are identified, addressed and configured during the initialization phase. Device channels are allocated to each slave in the MDT and AT. The slaves read data from and write data to the channels. Up to 4 MDTs and 4 ATs are sent from the master per clock cycle depending on the data volume. Telegrams transport data from device to device. The relevant command data is read or the requested status data is written in each of the devices.

Conventional Ethernet communication, for example e-mail, web services or other proprietary and standardized Ethernet-based protocols, are handled outside the sercos III telegrams in a so-called NRT (non-real-time) channel. This unencrypted NRT channel, which sits directly on top of the Ethernet layer, has a number of advantages:

- Slave test and configuration without initialized real-time Ethernet and master hardware
- Direct addressing of sercos III devices by means of the MAC or IP address
- Standard Ethernet devices such as laptops can be connected directly to sercos III devices via any free sercos III port.
- Full computational performance for the application, because the master does not have to encrypt or fragment the Ethernet packages.

sercos III - highly flexible and open for all types of communication



sercos III has a robust, clearly-defined data structure which enhances operational reliability and simplifies application development. The status of the entire network is always transparent and unambiguous. This creates the ideal conditions for simple system diagnostics at every node using standard or specialized Ethernet diagnostic tools.

sercos III telegrams contain a sercos III header and a data field which are embedded in the Ethernet frame. The sercos III header describes the current network phase and the position of the MDT (Master Data Telegram) and AT (Acknowledge Telegram) in the clock cycle. The MDT and AT data fields are subdivided into three sub-fields:

- Hot-plug field: Used to exchange data with slaves that are coupled into the network during operation
- Service-channel field: Sum of the communication channels for exchanging acyclic data between the master and slaves
- Real-time data field: Used to implement acyclic, cyclic, or synchronous connections and thus realtime communication between any participants in the sercos III network





The sercos III network – trust in a well-practiced team

sercos III networks have a master to maintain control and at least one slave to execute the automation functions. The devices are configured in a simple, clearly laid out line or ring topology.

Every sercos III device has two communication ports, which are connected to the previous and next devices via a CAT5e Ethernet cable. The sercos III line and ring topologies eliminate the need for expensive network technology such as switches or hubs.

Line topology

All of the sercos III devices are connected in a series. The master is located at the start of a line or between two lines. The data passes through the slaves and is looped back by the last device. All of the users analyze the data that is passing in both directions, and this guarantees that all data reaches each user during one cycle.

• Advantage: Simple, low-cost device networking over long distances, e.g. assembly or processing lines.



Whether you choose line or ring topology, your sercos III network will be simple and clearly laid out.

Ring topology

An additional cable can be used to form a sercos III ring network – between the last slave and the master for a single line, between the two last slaves for two lines. The master sends data to the ring in opposite directions from the two ports. The data which is traveling in each direction can be analyzed.

• The advantage: The ring topology offers the added advantage of redundant cabling, which improves fault tolerance. This means that a ring break can be tolerated without losing synchronization or disrupting communication.

Other topologies

sercos III also supports hierarchical, cascaded network structures. Single network segments are connected with each other using a ring or line topology.

The advantages:

- Real-time capable, fully synchronized network structures are implemented by coupling network segments.
- The cycle times in the individual segments can vary, e.g. 250 µs to network drives and fast I/Os and 2 ms to network control systems.

- Synchronization is assured in the complete network.
- All network nodes can communicate with each other in real-time.

Maximum availability with ring redundancy

A network with a fail-safe ring topology remains available without interruption when a slave is connected or disconnected (hot-plug) or in the event of a cable break. The additional cable in a ring network maintains the link to the master even if a cable breaks. The sercos III switches for the slaves change over without delay to two separate lines with loop back at the point where the break occurs. The reconfiguration time is 25 µs at the most, which ensures that only data from one communication cycle can be lost. The break can be pinpointed, and the defective cable can be easily replaced during ongoing operation. Redundancy also makes it possible to plug devices in or out for maintenance or to add additional devices. The system automatically continues to operate seamlessly using the new configuration.

Short distances

Direct communication across all devices, including cross communications between drives or controllers, makes sercos III the ideal choice for distributed intelligence and full realtime performance. Indirect communication between slaves which is routed through the master would pose a risk for synchronous motion, for example on gantry axes, or increase response times. Using cross communication, sercos III slaves can communicate with each other directly with minimal communication idle time, providing the basis for unrestricted real-time communication and intelligent automation configurations. The same principle applies to direct communication between controllers.

Perfect timing

sercos III defines the measuring of actual values and set-point validity for processes that are to be synchronized, regardless of product or manufacturer. Due to the physical characteristics, it takes a certain amount of time for a data message to reach a node. In contrast to other Ethernet bus systems, sercos III uses the bus directly to derive a common execution time. The devices compare their cycles decentrally with the bus cycle through the receipt of the MSTs, by taking into consideration the runtimes on the bus for generating and resetting the internal synchronization mechanism during each bus cycle. As a result, exact synchronization can be achieved without the need for a bandwidth-intensive exchange of timing data as for distributed clocks.

Cross communication – faster data exchange between nodes



sercos III – uncompromising precision and efficiency

X7E3

Because it delivers excellent performance in practical application, sercos has become the leading drive communication technology. High data transfer rates and high-precision synchronization make sercos III the solution of choice for deployment of centralized or decentralized automation systems.

XTET



sercos III makes maximum use of the available bandwidth

Optimal bandwidth utilization

With conventional Ethernet protocols in an office environment, user data which is embedded in a defined framework of protocol overhead data is sent as individual packets to each device.

When the amount of information which has to be sent is small (for example, simple set point data), the overhead accounts for a disproportionate amount of the total data traffic.

Here is a simple example which demonstrates efficient use of Fast Ethernet bandwidth:

If 4 bytes of status data were sent individually to 20 devices, 1,680 bytes = 20*84 bytes would have to be transferred (the minimum Ethernet packet size is 64 bytes), but only 80 bytes would be used productively for the application. This equates to about 5% of the bandwidth even with the shortest cycle time. In sercos III telegrams, all of the device user data up to 1,494 bytes is bundled together plus 44 bytes of overhead data. With a maximum packet size of 1,538 bytes, the bandwidth which is available for productive data increases to as much as 97%.

Keeping jitter to a minimum increases precision

Real-time precision requires timely receipt of signals and ideally simul-

taneous signal receipt and execution. sercos III cyclic communication ensures this signal timing, and a unique synchronization mechanism and the resulting minimal jitter guarantee maximum real-time precision.

Automatic telegram optimization increases efficiency

The number and length of the telegrams on the real-time channel are automatically adjusted to match the application data volume and number of nodes that are registered. The cycle time can also be pre-selected for optimal bandwidth utilization, or it is automatically adjusted to match the data volume on the real-time channel. The portion of the cycle which is not used by real-time telegrams is available for Ethernet-based communication on the non-real-time channel. Telegram size, cycle time and NRT channel bandwidth can be adjusted to make maximum use of the network bandwidth for each application.



Real-time data, NRT communication and cycle time at a glance

Cycle time in µs	Cyclical data per device in bytes	Max. devices (w/o NRT channel)	Max. devices (w/ NRT channel, 250 bytes = 20 μs)	Max. devices (w/ NRT channel, 1500 bytes = 125 μs)
31.25	8	7	2	_
62.5	12	14	8	-
125	16	26	21	_
250	12	61	57	30
250	32	33	31	17
500	12	122	120	94
1,000	50	97	95	85
1,000	32	137	134	120
1,000	12	251	245	220

Safety included – CIP Safety on sercos

CIP Safety on sercos is the protocol used to transfer safety-related data on the sercos interface. It was defined in collaboration with ODVA and has been certified for compliance with IEC 61508 up to SIL 3. No additional cabling for a safety bus is required as the safety information is sent in addition to the other real-time data on the sercos III network.

The combination of drives, peripherals, safety bus and standard Ethernet in a single network simplifies handling and reduces hardware and installation costs, and it makes it easy to deploy integrated safety controllers and homogeneous safety solutions.

CIP Safety on sercos means:

- The CIP Safety standard is used for safe data transmission
- CIP Safety adapted to sercos
- sercos-specific safety profiles



With CIP Safety on sercos, the data is sent on the same medium using the same connection as other communication. The function of the CIP Safety protocol, which is independent of the transport protocol and medium, is performed by the end units, making it possible to simultaneously operate standard and safety devices in the same network.

Reliable communication can take place on and between all network levels. The master does not necessarily have to be a safety controller. It can also route data without having to interpret it.

This makes it possible for users to flexibly configure the safety network architecture for implementation of safety programmable controllers or direct transmission of safety data between sensors and actuators. In addition, use of a standard CIP network as an overlaid network enables seamless communication between safety devices in different sub-networks.

sercos III makes maximum use of the available bandwidth

sercos safety data container - for transferring all safety-related data



Safety-related data is sent in a safety data container which is placed on the real-time data channel (MDT and AT) similar to standard data. A multiplex protocol, the so-called sercos Messaging Protocol (SMP), is used to transmit differently sampled safety data without a loss of bandwidth and despite short cycle times.

CIP Safety is a network protocol for functional safety. It has been certified by TÜV Rheinland for use in applications up to Safety Integrity Level 3 (SIL3) and complies with IEC standard 61508 for functional safety ("Functional safety of electrical/electronic/ programmable electronic safetyrelated systems").

DeviceNet, CIP, and CIP Safety are trademarks of the Open DeviceNet Vendors Association, Inc. (ODVA). Ethernet/IP is used by ODVA under license.



"The importance of safe bus systems continues to increase in industrial automation. The sercos safety concept is an essential element of modern system design."

Klaus Kemp,

TÜV Rheinland Industrie Service GmbH/ Project Manager Functional Safety/Software

What is CIP?

The Common Industrial Protocol (CIP) is a network-independent application protocol that is independent of the transmission medium and transport protocol used. This industrial protocol is used in field buses and industrial networks, such as DeviceNet, ControlNet, and EtherNet/IP. The CIP protocol is located above the transport layer and extends the pure transport services to include communication services for automation technology. This includes services for cyclic, time-critical and event-driven data exchange.

CIP technology is maintained, developed, and marketed by the organization ODVA (Open DeviceNet Vendors Association, www.odva.org).

Simplifying the process – from upfront engineering to maintenance

Configuration, commissioning, diagnosis, and maintenance of sercos III networks is quite easy. You concentrate on the application – sercos III will manage your network, so you don't have to deal with problems and troubleshooting.

All devices are connected with standard CAT5e cables. The network is synchronized and ready to go following a brief initialization phase. Devices which have been hot-plugged are automatically integrated into the communication and real-time data exchange during ongoing operation.

The benefits

- Automatic device detection eliminates the need for pre-settings and address allocation during start-up. Address switches are available to set addresses manually if necessary
- Automatic detection and resolution of address conflicts
- Simple, robust cabling avoids mistakes during installation and maintenance, because both device ports function identically, and there is no need to distinguish between the two when cables are attached
- Simple spare part management, because patch and cross-over cables are interchangeable



- Service PCs can be attached to the sercos III network even if no master hardware is present during installation
- Full diagnostic capability including automatic detection of the topology and connection order of the nodes, localization and circumvention of cable breaks
- Hot-plugging makes it possible to repair or modify the system without affecting the rest of the network
- Option for vertical integration through the use of Ethernet-based protocols



Assurance of interoperability between devices from different manufacturers

sercos conformity tests are carried out by authorized test labs at the Institute for Control Engineering of Machine Tools and Manufacturing Units (ISW) at the University of Stuttgart and at the Steinbeis Transfer Center for System Technology (STZ) in Esslingen.

The sercos conformizer is used for the official conformity test for slave and master implementations, which is the basis of formal certification.

The sercos conformizer can also be purchased by manufacturers to check their product's conformance with specifications during the development phase or for use in development of sercos products. This reduces development time and optimizes conformity tests.

A PCI card is used as the test hardware for the sercos conformizer. The test cases can be configured using a script language and run automatically. Test results are output directly in a log file and can be used as proof of conformity. Using the script language and configurable ID number database, it is possible to easily adjust and extend the test cases and also integrate manufacturer-specific tests. The manufacturer receives an official certificate of conformity from sercos international after the conformity test has been passed.



"sercos III is an open communication interface which is used in devices supplied by a range of different manufacturers. Immediate, problem-free device interoperability is only guaranteed if the manufacturers adhere strictly to the specification. On behalf of sercos international, we conduct conformity testing on all sercos devices in our test lab. Users thus have the confidence that certified sercos devices are truly compatible."

Armin Lechler, ISW, University of Stuttgart/Control Technology Department Manager

Simple hardware implementation

Manufacturers can easily integrate sercos III into their own systems. Different hardware and software options are available for this.

Communications controller

A communications controller is used to provide sercos III connectivity

- based on an FPGA logic chip or
- as a general-purpose multi-protocol Ethernet controller or
- based on a standard Ethernet controller (soft master)

Various versions of the "Xilinx Spartan" and "Altera Cyclone" FPGA chips are available for sercos III. The sercos III software core can also be added to existing FPGA solutions.

Easy Slave

The FPGA-based Easy Slave can be used for basic I/O periphery, e.g. encoders, measuring sensors or valve clusters. This is a single-chip implementation without an additional CPU and can be integrated into slave devices with minimal development and integration efforts.





"For over 15 years, sercos has fulfilled all our requirements: its openness allows us to maintain full control over our technology. Proven functions and comprehensive diagnostic options are critical for our core business – providing high-quality processing solutions to our global customers. sercos is the basis for highly efficient, easy-to-handle and failure-proof production systems."

Toshihiro Yonezu, JTEKT Corporation/Manager CNC Group

PC plug-in cards

Fully assembled expansion boards can be used to connect standard PCs to a sercos III network. Versions are available with a dedicated CPU (active boards) and without a CPU (passive boards). Cards are integrated via PC bus systems such as PCI.

Starter/evaluation kits

To make the transition to sercos III even easier, PCI boards for standard PCs, along with master or slave software, are available for training purposes. There are also WinCE drivers for X86 platforms.



netX-based plug-in card



Active PC plug-in card



Passive PC plug-in card

Always the right sercos III hardware for your application



The Hilscher "netX" multi-protocol Ethernet controller supports sercos III master and slave connectivity.

All of the controllers are available in a number of versions which cover the performance spectrum from simple I/O controllers and drives to master controllers and control systems.

Protocol stacks

Several companies offer protocol stack software for master and slave connectivity and different operating systems. Training, consulting and support are offered in addition to different license models.

Soft master

Using a soft master, a sercos III master can be implemented without any special hardware. Standard Ethernet controllers are used instead of the specific sercos III hardware. sercosspecific hardware functions are moved to the hardware-related and real-time capable part of the master driver. Thus, a master can be fully implemented in the software. Such a concept is, for example, interesting for PC-based control platforms that have an "onboard" Ethernet interface.





"At 3S, there was never any doubt that we would implement sercos III in our CoDeSys system. We have had very good experience with sercos II. The excellent level of drive profile standardization allows us to operate devices from a variety of manufacturers without time consuming driver development or modification."

Manfred Werner,

3S-Smart Software Solutions GmbH/Managing Director



Design-in sercos III interface



netSwitch



Ready-to-install sercos III communication module

Behind the scenes – sercos international e.V.

sercos III technology is open, non-proprietary, and freely available. The independent sercos international e.V. user group has been using this approach since 1990. In addition to representing the interests of its members, the user group provides an efficient and open forum for experts, supporters and interested parties who make active contributions.

The oldest international user group for real-time communication pools the expertise of more than 60 member organizations around the world, and it has subsidiaries in North America and Asia. Offices have been set up in Germany, the USA, Japan, and China.

15-20 companies are constantly represented by appropriate specialists in the working groups of the sercos organization. To coordinate the different activities, the sercos steering committee (SSC), consisting of all working group leaders, meets regularly.

Basic principles

- The sercos interface is a truly open standard.
- The technology and user organization are completely independent of the individual companies.
- Membership in the organization is voluntary and is thus not required to implement and use sercos.
- Experts from member and nonmember organizations can actively contribute to the development of the sercos interface in the engineering working groups.
- sercos undergoes continuing development – the developers give due consideration to suggestions which arise during practical application in a wide range of industries.

- sercos international e. V. is an officially recognized partner of the Industrial Electrotechnical Commission (IEC) and actively contributes to the committees of SC22G (Adjustable speed electric drive systems incorporating semiconductor power converters) and SC65C (Industrial Networks).
- sercos international e.V. cooperates with other industry associations (e.g. the North American OMAC) to jointly discuss requirements and solutions with end users and machine builders.
- Experts from the sercos working groups participate in a number of national and international industrial unions and standardization committees.



"Machine manufacturers demand faster and faster, highly precise motion as throughput requirements increase. Operator safety requires more and more intelligent machine function awareness and control. The future demands ever greater energy efficiency. sercos is at the forefront of meeting these demands with a level of reliability and flexibility that is unsurpassed."

Michael Binroth, President of G H Binroth Co.

User benefits

- Devices which are based on sercos interface technology offer excellent performance. They are designed for practical application, comply with standards and are future-proof.
- The product range, sources, support and training are not dependent on individual manufacturers and proprietary standards.
- The technology is supported by established global players including Bosch Rexroth, Rockwell Automation, Schneider Electric, and Phoenix Contact.

Other advantages for members

- Opportunity to put own requirements and suggestions forward for consideration during the continuing development of sercos
- Active members are always up-todate with the latest developments
- Common platform for marketing and presentations, e.g. at trade shows

sercos competence centers

Competence centers have been set up worldwide in order to advise companies in an independent and competent manner. These currently include the following institutions:

- ISW at the University of Stuttgart (D)
- University of Akron (USA)
- Technical College Alexandria (USA)
- HEIG-VD (CH)
- Beijing Polytechnical University (China)
- Steinbeis Transfer Center for System Technology (D).

Structure of the international sercos international e. V. user organization.





Consolidated know-how – worldwide

sercos international member companies



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