SERCOS III – 3rd Generation Hard Real Time
New functions create new opportunities and additional potential

Position Data 4000 Times Per Second
“Making music” from your servo motor with SERCOS

Open Architecture Facilitates Modular Automation
Rexroth’s IndraMotion controllers take full advantage of SERCOS III
A Blend of Tradition and Innovation

Since SERCOS was introduced at the beginning of the 90s, it has carved out a solid position in the market as an open real time motion control interface for automation engineering applications. The fact that it is an efficient, deterministic communications protocol based on optical transmission with good noise immunity is a major reason why SERCOS has been such a big success in a variety of industries and applications. The popularity of SERCOS in all of the world's large automation markets is reflected in the SERCOS organization, which looks after marketing, engineering development and standardization of the technology in collaboration with the member companies.

When we took the decision three years ago to develop an Industrial Ethernet-based implementation of SERCOS, we set the stage for the future success of the technology. The familiar, proven SERCOS mechanisms including the Motion Control Profile, telegram-based communications and hardware synchronization were migrated to the Ethernet standard with maximum backwards compatibility. The combination of SERCOS and Ethernet opens up a whole new range of possibilities and creates important synergies which are particularly evident in the standardized cabling and end-to-end communications which SERCOS offers.

Besides a dramatic increase in performance, SERCOS III offers a large number of new functions and very easy handling while retaining its unique real time characteristics. SERCOS now offers greater versatility for any application.

Following publication of the SERCOS III specification in November 2004, work has continued on two supplementary features which open up another new range of possibilities. SERCOS safety is a SERCOS III compatible protocol extension which accommodates safety applications up to SIL 3 with minimal cycle times and which achieved TÜV approval last year. SERCOS IO is an enhanced device profile for distributed I/O components, which is supported by well-known terminal block manufacturers, and it will be available by the middle of 2006.

SERCOS has now definitely made the transition from a specific drive interface to a universal real time Ethernet solution.

We wish you pleasant reading

Dr. Karl Tragl, Chairman of SERCOS International

Quick-Info 001
**SERCOS III – 3rd Generation**

**Hard Real Time**

New functions create new opportunities and additional potential

The initial SERCOS III products and applications signal the start of 3rd generation SERCOS and a new generation of real time communications. In contrast to other real time Ethernet solutions, SERCOS III is based on technology which has a proven track record in the market over the past 15 years. This approach simplifies migration of existing solutions, and a whole series of new functions, protocols and profile extensions expand the range of potential applications.

**Introduction to SERCOS III**

In order to use Ethernet in hard real time environments, SERCOS III has added a collision-free real time channel which runs in parallel with an optional non real time channel. SERCOS telegrams (Etitype 0x88CD) are transferred on the collision-free channel. This channel features excellent protocol efficiency to ensure best possible performance even when a lot of nodes are attached and data volumes per device are low. A non real time channel can be configured in parallel with the real time channel to carry Ethernet messages and IP-based protocols including TCP/IP and UDP/IP.

Because SERCOS III uses an evolutionary approach, existing advantages are retained, and a whole range of new features significantly extends the range of potential applications.

SERCOS III is based on a ring topology. The full duplex capability of the physical Ethernet infrastructure is used to achieve redundant data transfer based on a double ring topology rather than a single ring. Communications are not interrupted if there is a cable fault anywhere in the ring. The system continues to run without problem, and an integrated diagnostic function identifies the defective cable link or station, which can then be repaired without affecting machine availability. A linear topology may also be used. It does not offer the advantage of redundancy, but it does eliminate one cable. This can be very helpful on very large systems. SERCOS III does not use the star topology of standard Ethernet, and there are no hubs or switches.

Propagation delays and jitter are reduced to a minimum, because real time data is processed on the fly as it passes through the nodes.

Installation of a SERCOS III network is very straightforward and does not require special network configuration. Patch or crossover cables are used to connect all of the nodes. The device Ethernet ports are interchangeable and can even be used to connect standard Ethernet devices (such as notebooks) to a SERCOS III domain. Ethernet or IP protocols can be used to access SERCOS III devices without affecting the real time behavior of the SERCOS III domain.
### SERCOS I - III in comparison

<table>
<thead>
<tr>
<th></th>
<th>SERCOS I</th>
<th>SERCOS II</th>
<th>SERCOS III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year launched</td>
<td>1997</td>
<td>1999</td>
<td>2005</td>
</tr>
<tr>
<td>Physical medium</td>
<td>Optical fiber</td>
<td>Optical fiber</td>
<td>Ethernet</td>
</tr>
<tr>
<td>Network topology</td>
<td>Ring</td>
<td>Ring</td>
<td>(twisted pair)</td>
</tr>
<tr>
<td>Transmission rate</td>
<td>224 Mbit/s</td>
<td>2448 Mbit/s</td>
<td>190 Mbit/s</td>
</tr>
<tr>
<td>Cycle time</td>
<td>Configurable, minimum 62.5 µs</td>
<td>Configurable, minimum 62.5 µs</td>
<td>Configurable, minimum 31.25 µs</td>
</tr>
<tr>
<td>Jitter</td>
<td>&lt; 1 µsec</td>
<td>&lt; 1 µsec</td>
<td>&lt; 1 µsec</td>
</tr>
<tr>
<td>Synchronization</td>
<td>Basic protocol</td>
<td>Hardware synchronization</td>
<td>Ethernet</td>
</tr>
<tr>
<td>Real time protocol</td>
<td>HOC</td>
<td>SERCOS</td>
<td>Yes, with ring topology</td>
</tr>
<tr>
<td>Hardware redundancy</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Cross communication (slave-to-slave)</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Communication and synchronization between controllers</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Service channel</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Optional IP channel</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Hot plugging</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Number of masters</td>
<td>1 per ring</td>
<td>1 per ring</td>
<td>1 per ring line</td>
</tr>
<tr>
<td>Maximum number of nodes</td>
<td>254 per ring, several rings possible</td>
<td>254 per ring, several rings possible</td>
<td>254 per ring, several rings possible</td>
</tr>
</tbody>
</table>

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**Dedicated real time channel for cyclic transfer of real time data**

Communications settings, parameters and diagnostic data can be exchanged between the master and the slaves or between individual slaves on the SERCOS service channel. To maintain compatibility, this channel is still available in SERCOS III. The new standard also supports the optional non real time channel which can be used to transfer standard internet frames (e.g. TCP/IP or UDP/IP messages). The communications cycles and sharing of the 100 Mbit/s bandwidth between real time and non real time channels can be modified to meet the needs of the individual application.

**Ideal for centralized and distributed drive solutions**

SERCOS III cuts the minimal achievable cycle time in half from the current 62.5 µs to 31.25 µs. The higher bandwidth of the physical Ethernet infrastructure supports a sufficient number of slaves even at these extremely short cycle times. SERCOS III accommodates both distributed drive solutions and solutions with central signal processing. In distributed drive applications, all control loops are closed in the drive control unit, and they can be implemented using technology functions. With centralized drive architecture, only the current control loop is closed in the drive control unit. The control loops for multiple axes are implemented in central control electronics.

**Cross communication between slaves**

Due to the unidirectional nature of fiber optic links, it was not possible to directly exchange data between slaves on the previous two generations of SERCOS. SERCOS III uses the full duplex capability of Ethernet to support cross communication (CC).

**Controller cross communication based on the C2C profile**

SERCOS III also supports communications and synchronization between several motion control units. Several machine modules in a network can be synchronized, and time-critical data can be transferred between controllers. The C2C (controller-to-controller) profile, which is based on the basic SERCOS III protocol, has been defined to provide this functionality. The specification has been published at the 2006 Hanover Fair.

**SERCOS safety**

SERCOS III reflects the increasing importance of safety engineering. The safety features, called SERCOS safety, are implemented in a SERCOS III compatible protocol extension which makes SERCOS III suitable for safety applications up to SIL 3 as defined in IEC 61508 even at minimum cycle times. Safety-relevant data is transferred along with real time data and other standard Ethernet protocols on a single physical medium. The safety data container which is embedded in a SERCOS data telegram can carry up to 64 bits of safe user data. Using the specific cross communication mechanism, safe data can be transferred directly between slaves without first being retrieved by a master (safety controller) and redistributed. Because SERCOS safety is independent of the transport layer, other physical transfer mechanisms can be used besides SERCOS III. The routing features of the protocol make it possible to extend a safety network to multiple lower level networks.

The SERCOS safety concept was tested by TÜV Rheinland in December 2005. Initial SERCOS products will become available in 2006.

**SERCOS III device model and the enhanced I/O profile**

Over the past fifteen years, the SERCOS servo drive profile has developed into an established, mature device profile. It provides a rich set of functions which have a proven track record in a wide variety of applications. The device profile has undergone a process of expansion and generalization during the migration to SERCOS III. In the future, it will support hybrid devices which combine different applications in a single device as well as dedicated drive, I/O and control devices. New device profiles for other types of actuators and drive designs (closed and open loop drives, etc.) and for I/O modules, technology modules, controllers and monitoring devices will be defined and standardized. An enhanced device profile for distributed I/O units is currently under development. The profile is suitable for modular I/O units with bus couplers and block I/O devices. The specification will be available in the middle of 2006.

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**SERCOS safety technical data**

<table>
<thead>
<tr>
<th>Single cast connections</th>
<th>16384</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multi cast connections</td>
<td>1024</td>
</tr>
<tr>
<td>Number of safety nodes</td>
<td>10000 (1ms)</td>
</tr>
<tr>
<td>Number of safety multi-cast nodes</td>
<td>15</td>
</tr>
<tr>
<td>Min. cycle time</td>
<td>31.25 µs</td>
</tr>
<tr>
<td>Typical cycle time</td>
<td>1...10 ms</td>
</tr>
<tr>
<td>SIL Level (down to min. cycle time)</td>
<td>SIL3</td>
</tr>
<tr>
<td>User data</td>
<td>2.8 bytes</td>
</tr>
<tr>
<td>Overhead</td>
<td>11 bytes</td>
</tr>
<tr>
<td>Redundant network</td>
<td></td>
</tr>
<tr>
<td>SERCOS safety across multiple SERCOS networks</td>
<td></td>
</tr>
<tr>
<td>Direct data exchange between safety slaves in a SERCOS networks</td>
<td></td>
</tr>
<tr>
<td>Direct data exchange between safety slaves across multiple SERCOS networks</td>
<td></td>
</tr>
<tr>
<td>Topology</td>
<td>Line/Redundant</td>
</tr>
</tbody>
</table>

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Quick-Info 002
The Task

Many a complex requirement has ...

The Result

... a very simple solution: Automation House

Automation House from Rexroth. Automation simple and smart.

Automation processes are becoming more and more complex and ever more demanding. But no matter how high your expectations are, we have the right solution for you. Automation House from Rexroth. Every component you'll ever need for your winning automation concepts is here. From open control systems through intelligent drives all the way to an ingenious framework for standardized engineering and user-friendly operation. All from one single source and fully compatible – from the technology leader with a global presence. A whole world of automation under one roof: Bosch Rexroth

The Drive & Control Company

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Bosch Rexroth AG
www.boschrexroth.com/automationhouse
The Manz aico.control is an open PC controller which can be installed on any Pentium platform. Hardware scalability ranges from the pure Soft Motion variation and embedded systems for the OEM market to turn-key robotic control including servo drive systems. This solution offers excellent adaptability to application and customer requirements.

A Win tool (aico.assist) helps users to quickly and easily configure and commission all hardware and software components. Other features include an HMI, work flow management and drive components which communicate via standardized interfaces including Ethernet, SERCOS, CAN, OPC etc. Integration into a vertical automation architecture is possible at any point.

Programmers can write software in user-friendly basic, or they can use the CoDeSys IEC 6-1131-3 programming tool. The controller has a VxWorks real time kernel with full multi-tasking functionality. Complex automation processes can be implemented including up to 256 parallel user tasks. All motion control, PLC and process functions are combined on a single platform. The powerful, user-friendly application framework reflects many years of automation project experience.

The core element is a high-end continuous path control which can synchronously position up to 48 servo axes (jitter <1µs). All of the motion control functions and multi-axis interpolation are handled separately on the PC controller. A wide variety of drives can be connected via the IEC 61491 compliant drive interface.

From the beginning of 2007, aico.control will support all standard RT Ethernet protocols in addition to fieldbus standards. Manz offers SERCOS III as a system bus including servo drives. The motion control portfolio includes an extensive range of servo drives detection, measurement, color matching and classification.

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Seamless control architecture is a major productivity factor
Simple Migration Path to SERCOS II

Phoenix Contact’s PC Worx Softcontrol MC PLC is a high-performance sequential control system with integrated motion control. A variety of motion control functions including electronic gears, cams and flying saw are implemented in the same PLC program.

A library of standardized IEC 61131 function modules complying with PLCopen FBS for Motion Control is provided. The entire engineering framework for a machine is handled in a single tool, eliminating the need for cumbersome interfaces. Powerful PC Worx functions simplify commissioning and provide comprehensive diagnostic support. The solution reduces engineering effort and increases the clarity of PLC programs in handling, assembly and packaging applications. High-performance PCs can handle up to 80 axes. Short cycle times (1 ms), high speed and excellent precision can be achieved by combining INTERBUS and SERCOS. The system will also accommodate a variety of drives.

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CONTROLLER-COUPLED REAL TIME SIMULATION OF PRODUCTION SYSTEMS

CONTROLER INTERFACING
- Actual fieldbus and drive bus (SERCOS, Profibus)
- I/O and drive interface
- Combination of actual and virtual machine and plant components

REAL TIME SIMULATION
- Bus cycles < 1 ms
- Standard PC (real time without additional hardware)
- Simulation for PLC and NC applications
- Cross-sector modeling

APPLICATIONS
- Controller testing and startup
- No-risk testing of PLC and NC applications
- Testing of fault conditions and illegal operating states
- Training and marketing
A number of visitors to the andron GmbH stand at the GrindTec show in Augsburg, Germany were taken aback when they saw someone holding a watering can next to the servo motors which were on display. Music that sounded like a gramophone was coming out of the watering can. However, the message that the team at the show wanted to convey had nothing to do with old recording technology. Using the watering can to amplify the sound was intended to demonstrate the outstanding performance of a new motion control system family, the CNC andronic 2060, in combination with the andronid 1000 digital servo controller.

Intensive testing has shown that a block cycle time of less than 250 µs can be achieved on the andronic 2060 during execution of G&M code programs. Because position data can be transferred to the drive controller 4000 times per second on the andronid 1000 (250µs SERCOS cycle), it is possible to produce audible music with the motor following conversion to an G&M code program. A one-half degree rotation of the motor shaft corresponds to the travel of a loudspeaker membrane.

Despite the fact that precision, high-speed position commands ought to be sufficient to produce music of reasonable quality (position information can be transferred 4000 times per second), you actually need 100% speed and acceleration pre-control to achieve good audio quality (due to a small servo lag error). The look-ahead feature of the andronic 2060 CNC controller (min. 2000 G&M codes look-ahead with no speed limitations) provides a solid basis for pre-control, and it ensures that path commands to the drive amplifier remain within the desired position, speed, acceleration and jerk rate limits. Pre-control up to the third-derivative is certainly better than having to make continuous corrections.

This is all very interesting, but what are the applications for a system in this speed category? There is increasing demand for complex multi-axis continuous path control which must meet stringent contour accuracy or finish quality requirements. The range of applications ranges from tool grinding and HSC milling in mold making to special applications such as high-precision eccentric grinding or production of progressive lenses for eyeglasses.

With the SERCOS interface, position commands can be sent synchronously to all of the servo drives which are on on the link between the NC and the servo drives. Due to high clock consistency, every drive can use fine internal interpolation to perform 100% speed and acceleration pre-control. It makes no difference whether data is supplied to one drive or sixteen.

The system also offers total noise immunity, because the data is sent via a fiber optic link. Experience shows that no faster, more reliable and better synchronized interface between controllers and the drives is available on the market today.

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## Simple Migration to SERCOS III

When the SERCOS standard was introduced at the end of 1980s, it set the standard for real time communications in automation applications. SERCOS III makes this proven standard available on Ethernet.

Automata now offers hardware modules and driver software for the next generation SERCOS as well. On behalf of IGS, Automata is responsible for the FPGA implementation of the standard, which means that the company will be able to provide customized SERCOS III for use in customer-specific products in addition to the standard FPGA implementation. Master and slave functionality can be combined in an FPGA with additional functions (e.g. µControllers) or application-specific functions to reduce interface costs.

Automata also supplies master and slave driver software for SERCOS III. The software is available as "C" code. It is very compact and has no operating system or platform dependencies. The basic versions of the master and slave drivers have all of the familiar SERCOS I/II functions. An IP channel, cross communications and hot-plugging are available as optional modules. Users can also use license-free master drivers for Windows XP® and CE.net®.

API compatibility with previous versions was a major design goal during development of the driver software. Migration
from SERCOS I/II to SERCOS III requires minimal effort. The API is identical, and all of the familiar functions remain unchanged. A PCI card with one or two SERCOS III interfaces is available for PC-based platforms. The two interfaces can be operated independently as master or slave.

The Automata A1 is a control system on a PC platform with integrated SERCOS III interface and a bus coupler for the WAGO 750 I/O system. The products provide a fast, simple, cost-effective migration path to SERCOS III. They can be used by OEMs as hardware and software components and by machine manufacturers who create their applications with an IEC-61131 tool for use on a finished controller solution.

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The idea is simple and compelling. Distributed automated modules replace highly complex automation solutions which are based on a central controller. The new approach reduces engineering, programming and installation complexity. More importantly, machine manufacturers can reduce manufacturing costs, and exploiting the advantages of modular design. This provides producers the flexibility to adapt the machine to suit customer preferences. This is exactly the approach Rexroth has taken with the new motion logic systems which are part of its IndraMotion family. The powerful IndraMotion MLD controllers at the drive level and the controller-based IndraMotion MLC are based on the non-proprietary SERCOS III standard, which is the Ethernet-based version of the SERCOS interface.

Rexroth offers two crucial elements for successful implementation of a distributed solution: excellent control solutions and open seamless programming.

This combination gives machine manufacturers what they need to design fully modular solutions and meet a wide range of customer requirements including fieldbus and process control.

Distributed modules perform high-quality motion control operations independently of cycle times in the higher-level controller, thus increasing overall system performance.

SERCOS III: Ethernet-based hard real time

Decentralized solutions require open, high-performance command communications. This is exactly what the non-proprietary SERCOS III real time interface on Rexroth’s motion logic systems provides. The third generation of the world’s only standardized drive interface combines proven real time mechanisms with the physical infrastructure of Ethernet. Obsolescence is not an issue for users of existing applications and the 1.5 million SERCOS nodes which are installed world wide. Machine manufacturers can exploit additional functionality including hardware-based synchronization, low-cost CAT5e cabling and enhanced safety. SERCOS III guarantees media redundancy without controller dependency in synchronous operation. A cable fault does not impair system availability, and all slave nodes in the ring topology continue to receive the synchronous clock. Logical addresses are used to access devices in a ring or line topology regardless of the network configuration. Hot-plug functionality enables SERCOS III users to attach additional nodes during ongoing operation. I/O peripherals as well as drives can be attached to the network, making SERCOS III a universal bus system which is suitable for all applications.

The C2C communications profile specifies standardized peer-to-peer communications between SERCOS III nodes. Autonomous machine segments, which have been automated using IndraMotion technology, can be linked and synchronized across segments while delivering hard real time performance. SERCOS III with C2C functionality incorporates two crucial elements of distributed, synchronous real time operation:

- distributed peer-to-peer communications at the master level: controllers can exchange data in a distributed environment across machine segment boundaries
- peer-to-peer communications at the slave level: I/O and slave nodes can establish a direct bi-directional communications relationship with each other (cross communication). This significantly enhances system performance, because the SERCOS master does not have to fetch and distribute the data. The load on the controller is reduced.

High data rates up to 100Mbit/s will support an IP channel for standard Ethernet protocols on the same medium as the cyclic real time data. Users of this high-performance, future-proof bus enjoy the benefits of an open communications system which supports controllers, drives and peripherals from a wide range of manufacturers. The versatile SERCOS III IP channel is another great feature for manufacturers and users. No SERCOS master is needed for IP communications. Installation, parameterization and diagnosis of SERCOS III nodes can take place without a controller.

In addition, SERCOS safety, which fulfills requirements up to SIL3 as defined in IEC61508 and which was recently approved and certified by TÜV Rheinland, has been available since the end of 2005. When it is used as a safety network, SERCOS supports hierarchical and distributed controller architectures as well as routing. Safety nodes on multiple SERCOS networks can exchange information in a distributed environment.

Turnkey technology functions cut down the engineering effort

Rexroth currently implements the SERCOS III real time solution in its controllers and intelligent drives. The multi-axis IndraMotion MLD motion logic solution which is based on the IndraDrive family of products combines sophisticated drive functions with flexible IEC 61131-3 compliant sequential control and process-oriented PLCopen technology modules including cam groups, print mark control, winders and on-the-fly ma-
chining. Customer response to on-board safety technology in the drives has been very positive. 50% of the IndraDrive units which Rexroth ships are now equipped with this technology. The safety functions including safe hold and safe motion have been certified for compliance to EN 954-1, Category 3, and the Rexroth “Safety on board” solution offers a special feature. With other designs, the machine has to be shut down at least every 8 hours for forced dynamics to detect “sleeping” faults. On Rexroth systems, the tests run automatically online in the background during normal operation without manual intervention.

The IndraMotion MLD synchronizes up to 8 axes using integrated SERCOS III communications in hard real time. Settling times are less than or equal to 50 ms. One drive acting as the master configures the drive ring and uses enhanced SERCOS parameters to communicate with the other drives. In CCD (cross communication drive) mode, the master drive acts as a communications gateway for process data which is on route to the slave drives.

**Runtime system not dependent of the hardware**

The controller-based IndraMotion MLC version, which can handle up to 16 intelligent IndraDrives, is the solution of choice when a large number of axes are involved. A hardware function module adds SERCOS III functionality to the rack-size controller. In addition to a large number of single and multiple axis functions, the basic version of the MLC controller offers a comprehensive library including technology func-

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**Our motivation:**

**Your drive!**

**SERCOS III coupler for the WAGO-I/O-SYSTEM**

- Full support for SercoS III V. 1.20 protocol and SERCOS-Safety
- Compatible with the SercoS III I/O profile
- Additional I/O fieldbus no longer required
- I/O-nodes synchronous with motion cycle
- Redundancy possible through ring topology
- 100 Mbit/s
- Cross communication
- Additional standard IP channel

www.wago.com

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The “C2C” communications profile defines standardized peer-to-peer communication between SERCOS III nodes.
The Rexroth IndraWorks engineering environment includes all of the tools which engineers need in a single point of engineering.

For a variety of sub-processes in applications such as packaging machines. On applications with an even higher number of axes, multiple MLC controllers can be linked via SERCOS III to create a controller cluster.

An IEC 61131-3 compliant IndraLogic PLC is used on some hardware versions. This significantly streamlines the programming effort, because programs and program segments can be re-used at various automation levels. This makes it easier to scale the modules to address a wide range of axis numbers and complexity levels. The Rexroth IndraWorks engineering framework makes things even easier for the user. It includes all of the key software tools and acts as a single point of engineering. The platform which is based on Microsoft’s .NET technology provides all of the tools which engineers need.

All of the engineering, programming and parameterization tools are consolidated in a standardized, intuitive software architecture. The entry-level version offers dialogue-based parameterization tools for drive systems. The top of the range version covers the complete engineering spectrum. Engineers are only presented with the functions which they need for the particular system and the required software components such as application-specific wizards or the new cam editor.

Bosch Rexroth AG, part of the Bosch Group, achieved sales of approximately 4.6 billion euros in 2005 with over 28,200 employees. Under the brand name of Rexroth the company offers all drive and control technologies, from mechanics, hydraulics and pneumatics through to electronics. Over 500,000 customers worldwide utilize Rexroth’s unique technological know-how to implement their innovative and future-oriented systems and machine concepts. The global player, represented in over 80 countries, is an extensive supplier of components and systems for industrial and factory automation and mobile applications.

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Presence at trade shows
- Hannover Fair, April 24th -28th 2006, Hall 9, Stand A43, Hannover/Germany
- Industrial Networks Forum, June 20th – 22nd 2006, Hall5 5, Stand A14, Zürich Exhibition Center/Switzerland
- PackExpo, October 29th – November 2nd 2006, McCormick Place, Chicago /USA
- SPS / IPC/ DRIVES, November 28th – 30th 2006, Hall 6, Stand 110, Nuremberg Exhibition Center/ Germany

Workshops SERCOS goes Ethernet
- Stuttgart, June 28th 2006 and Hannover, September 14th 2006

More information is available at www.sercos.de/workshops

Discussions/Conferences
- 1st ICOA Open Automation Conference, May 12th 2006, Shanghai /China
- Automation and Networking Conference, May 17th 2006, Birmingham / GB
- Industrial Networks Forum, 22.6.2006, Zürich Exhibition Center/Switzerland
- 4th Industrial Ethernet Congress July 4th – 5th 2006, Stuttgart /Germany

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Keeping in Step
Standard WAGO technology links to the WAGO I/O SYSTEM

Most drive systems manufacturers use the SERCOS fieldbus. At the Hannover Fair, WAGO will present a coupler for the WAGO I/O System, which fully supports the Sercos III V. 1.20 protocol and is compatible with the new Sercos III I/O profile.

The solution offers very good performance and excellent connectivity. There is no need for routing through another fieldbus. A 100 Mbit/s transfer rate, full synchronization with the motion clock and peer-to-peer communications give users what they need for time-critical applications, and the ring topology provides extra security (redundancy).

Safety applications can also be deployed as safety functions are an integral part of the system. An additional standard Ethernet channel, for PC applications for example, is also included. With its new SERCOS III couplers, which will be available towards the end of the year, WAGO will once again be playing a pioneering role. It would be hard to find similarly equipped peripherals on the market.

WHY WAGO
- Sercos III V. 1.20 protocol
- Sercos III I/O profile
- extremely compact I/O system
- very large selection of I/O terminal blocks

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Quick-Info 008

The WAGO 750 I/O SYSTEM, the compact universal fieldbus for industrial applications

SERCOS III
Hardware for master and slave
Driver software for master and slave
Controls and IO systems
Starterkits
Design - Consultation - Training

Realtime-Ethernet on proven base
Finding an answer to this question could apparently save machine producers a significant amount of money, and ISG, which is known for its popular and versatile NC and motion kernel, has developed a real-time engineering simulation environment called virtuos which solves the problem. Engineers can use virtuos to install, test and optimize actual CNC or PLC hardware and software on a virtual machine.

The virtual machine is created by simulating the behavior of an actual machine on a standard PC. Virtuos provides a graphical modeling tool which can be used to describe functional, kinematic and dynamic behavior in a form that is meaningful to engineers, namely as a block or detailed wiring diagram with physical Parameters. Simulation is based on a module library which can be enhanced by C programmers as needed. Linear MATLAB modules can also be imported and executed in real time without MATLAB. Modules for field and drive bus nodes, logic, control and drive devices, mechanical components, etc. can be combined to simulate the entire machine. The behavior model is linked to an underlying real-time operating system and executed in a cyclic/deterministic environment. Oscilloscope functions in the modeling tool allow users to monitor physical variables in the model. The cycle time depends on the bus which is used. It can be 0.5 ms for a SERCOS bus for example. The dynamic variables in the model can be calculated using an faster underlying clock rate.

Within the capability limits of the model, the simulation PC acts just like a real machine (hardware in the loop simulation) on SERCOS bus or Profibus. 3D visualization of the total machine, production system or entire plant is based on existing CAD models from the machine design phase in VRML format. The files are import-
ed and converted to moveable machine objects using virtuos tools. Virtuos is a tool for creating a holistic simulation of machines and production systems. It reduces commissioning time and supports the machine or system throughout the life cycle including sales, product development, commissioning, training, maintenance and service. Because virtuos can be integrated into PC-based controls (CNC or PLC), users do not need any additional equipment to take advantage of its impressive benefits (software in the loop simulation). Real-time capability, holistic engineering modeling and integration in the Real control are the outstanding features of virtuos.

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SERCOS III combines the advantages of proven real time mechanisms with the benefits of Ethernet communications. Hilscher offers three slave platforms which are based on netX technology:
- CIFX 50-RES PCI card
- COMX-CA-RES communications module
- netX 100, netX 500 communications controller

The ARM 926 CPU executes the communications portion of the SERCOS III protocol in the netX. The host system has access to the data and the configuration via a dual port memory.

SERCOS III Features:
- real time data
- service channel: read, write, standard commands
- synchronization
- initialization (phase acceleration)
- redundancy
- topology recognition: ring and line
- 2 RJ45 jacks
- simple LED-based diagnostics
- 3.3 V technology
- 100 MBit/s
- crossover function

With the netX 100 and netX 500, the application program and the communications can be implemented in a chip, and Hilscher can supply tools and evaluation boards for this purpose. netX includes four A/D converters, two encoders and a three-phase PWM for drive applications.

One of the big advantages of netX technology is the fact that the CIFX 50-RES, COMX-CA-RES and netX can be used for PROFINET IO, PowerLink, EtherCAT and EtherNet/IP.

Hilscher will be presenting products for SERCOS III at the joint stand (A43) in Hall 9 at this year’s Hanover Fair. Products for SERCOS III master are in the pipeline.

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Quick-Info 009 ▲

Quick-Info 010 ▲
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