SERCOS III on a course of expansion:
Semiconductor production and fluid technologies rely on open standard

SERCOS inside: First SERCOS III Conformance Test Certificates issued

Product-News: RZA-Ethernet Monitor – A powerful tool for analysis

Application: Virtual machine on the SERCOS real-time bus
Virtual worlds on a real bus

Virtual worlds are taking up an increasingly amount of our daily lives thanks to modern computer science. For science and engineers, these worlds offer answers to questions which would be difficult or completely impossible to answer in reality. The aim of making the unknown virtually known or gaining a virtual insight into the future is motivating scientists and engineers to develop methods which should allow them to gain answers to the unsolved questions using simulations. In industrial practice, this means virtually creating a product, optimizing it, putting it into operation and monitoring it in the operational phase. The numerous reports of how advanced this already is today. The use of simulation methods in the context of real hardware can be established through real-time simulation in automation technology.

Today Hardware-in-the-Loop Simulation is being particularly successfully used for implementing controller systems. Early testing of controller functions and programs allows reduced implementation times on the actual plant floor with a high test depth of the controller software. This requires the simulation to produce an exact illustration of the I/O behavior on the actual bus system. Not only short cycle times must be observed here, but also realistic values must be calculated against given set points. In complex production processes, this leads to high demands on the simulation models which could previously only be partially fulfilled. Today, the interaction between the machine dynamics, drive control and controller can be simulated well in real-time. The simulation of the processes, however, does additionally require the process dynamics to be considered, which still represents an unsolved problem for real-time simulation for many production processes. In turn, this is motivating scientists at the Institute for Control Engineering for Machines and Manufacturing Units at the University of Stuttgart (ISW) to design methods which would be difficult or completely impossible to answer in reality.

The conversion from the pure drive communication in the first SERCOS interface generation to the real-time-enabled SERCOS III has made clear progress. Currently, new applications in the semiconductor industry document the flexibility and performance of this open standard. Simultaneously, new SERCOS III interfaces for hydraulic and pneumatic actuators open up the advantages of Ethernet real-time communication for all drive technologies.

Whether it is about the highest precision, the synchronization of several hundred axes or the greatest flexibility possible for ever smaller batch sizes, SERCOS has proven its worth for many years, setting benchmarks in the machine tool, printing and packaging industries. Now, the first manufacturers of machines for the semiconductor industry are using SERCOS II for innovative concepts. For example: Smart Equipment Technology SAS, SET, with the new FC 300 for different front-end and back-end process steps in the chip production in process connection, the French manufacturer relies on the Rexroth NYCO 4000 Motion Control and SERCOS III as a universal bus. The Rexroth NYCO 4000 Motion Control especially optimized for the semiconductor and solar industry, integrates the entire control and drive hardware in one housing and requires less space than an industrial PC. The open software architecture offers extremely high flexibility in the automation of modules and complete machines. It coordinates up to ten linear, piston, stepper, servo synchronous or torque motors.

In semiconductor processes, process reliability plays a particularly important role. In contrast to most other industrial production processes, semiconductor production requires many process steps under vacuum or under protective gas. That is why automation solutions must simultaneously record and analyze many sensor signals synchronously into the SERCOS network and buffered in case of higher data traffic. SERCOS III on a course of expansion: Semiconductor production and fluid technologies rely on open standard

For more information, visit www.hilscher.com or see us at the HANNOVER MESSE 2010 in hall 11, booth 11-A62.
SERCOS III – the independent real-time high-performance fieldbus. Our customers deservedly expect only the very best solutions for drive and control technology. The core for such solutions is a comprehensive communication system. This is why we actively support the development of SERCOS III. It incorporates two standards: the proven real-time mechanisms and the internationally established Ethernet technology.

Bosch Rexroth. The Drive & Control Company

What all have Real-time Ethernet Communications.

Only SERCOS has Plug-and-play-standardized and non-proprietary.
Using IXXAT’s Industrial Ethernet Module (IEM), devices can be connected quickly and cost-efficiently to SERCOS III networks.

The IEM is based on a powerful Altera Cyclone III FPGA which includes an integrated 32bit CPU and Ethernet controllers, the PHY, magnetic modules and RJ45 jacks. The IEM is equipped with two Ethernet interfaces allowing easy set up of line as well as ring topologies by using the integrated switch or hub. The connection to the host system is made topologies by using the integrated switch or hub. The continuous development of the IEM minimizes the investment risk and ensures the customer’s long-term investment.

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Over 100 SERCOS III products and components are currently offered from more than 40 manufacturers. These products cover a broad range:

- complete automation solutions (package of controls, drives and/or I/O peripherals)
- automation devices (control systems, drives, I/O devices, other devices such as sensors)
- tools (development, configuration, diagnosis)
- hardware and software components (controllers, drivers, stacks)
- active and passive infrastructure components (switches, cables, plugs)

In addition, several innovative products are offered that support the integration of non-SERCOS III devices into a SERCOS III network. Examples of such products are:

- real-time switches to interconnect SERCOS III and other fieldbuses or RTE networks
- gateways to interconnect SERCOS III and other fieldbuses or RTE networks
- axis control modules that allow the connection between analogue axes and SERCOS III networks
- modular I/O systems for SERCOS III that offer a broad range of functions and interfaces

More than a dozen service providers offer consultation and support for device manufacturers that do not intend to develop and integrate a SERCOS III interface completely on their own.

The range of services covers development support, training, consultation, testing and even certification of SERCOS III devices.

Contact: SERCOS International e.V.
Küblerstraße 1, D-73079 Sindelsburen
Phone: +49 (0) 7162/9468-65
Fax: +49 (0) 7162/9468-66
www.sercos.de

Benefit from the advantages of IE-line connectors with STEADYTEC®-technology for your SERCOS III application.

- Safe: cable and IE-line connectors comply with the SERCOS III installation guideline
- Simple: field attachable RJ45-connectors in IP20 and IP67
- Reliable: high system security through innovative contact technology

www.weidmueller.com
Hardware-in-the-Loop Simulation (HiLS) has proven to be an important tool to be able to implement control of the machine early in the development process. HiLS not only examines the entire system performance but also the control engineering. This is achieved by linking the real control to a simulation which displays the machine behavior in such a way that the control cannot distinguish between the real and the virtual machines. As the controller expects actual values from the sensors in a fixed cycle (usually <10ms) and has to provide new set points, it is necessary that the machine operates in real-time. The control and the virtual machine are linked via the SERCOS real-time bus system. The virtual machine displays all of the bus devices contained in the machine via the bus interface so that, for the controller, there is no difference between the virtual and the real machine.

The benefits of HiLS are:

- Use of real control technology on the real plant is possible, whereby all control functions can be fully considered.
- Fully synchronous processes are thus very realistic from the point of view of both the controller and the user.
- No virtual image of the controller is necessary and thus there are no problems of availability from the controller manufacturer.

Besides the virtual implementation, there are other fields of application which are especially beneficial for the machine manufacturer. These are found in the machine development, the operation of the machine, in training and in the presentation. HiLS has particularly established itself as an aid in all disciplines in the field of machine development. The construction of a virtual machine opens up a common basis for discussion for all disciplines at an early stage. The increased exchange of information among the disciplines allows knowledge about the machines to build up, which means problems can be recognized early and the maturity level of the development is increased at an early stage. In particular, the software developers can benefit from the pre-implementation of the machine which it can carry out safely. The early implementation gives the programmer more time for the actual implementation, i.e., to test and validate the program available, in other words the “time-to-market” of the newly developed product is reduced. In addition to the development departments, the customer of the machine manufacturer also profits from HiLS. He/She can test various controllers using the virtual machine during the development process. In this way, the manufacturer of the controller is required to provide the functional proof of the controller from the outset. While the plant is being operated, optimizations can take place using the HiLS, without having to deal with shut-down time. In order to do this, these various scenarios for increasing the cycle time are used. The same applies for changing over the plant. While production is underway, control programs for the next product to be made can be prepared with the help of the simulation. This shortens the lead phase. In addition, the possibility of using HiLS to support the machine diagnosis is currently being investigated. By comparing the current or torque flows of the motors in real and simulated machines, conclusions can be drawn regarding possible errors and wear of the machine, which can, in turn, be used for a maintenance plan.

Another field of use of HiLS is the training of machine users. With the help of HiLS, it is no longer necessary to use real plants in training; training can be carried out on the real controller with the machine model in separate training rooms. This avoids costs for expensive training equipment or shut-down times of the actual plant.

Core topics of current research activities are the detailing and display of dynamic behavior in real-time models. This includes finite elements, FE models and models of the machining process. Reduction procedures and calculus are being investigated for FE models which provide for efficient real-time calculation with excellent accuracy. Besides the development of new simulation methods for real-time calculation, the description of re-usable models for virtual knowledge-based product development is another research topic. Here, simulation methods are generally developed so that they can be generated for various simulation tools and do not have to be re-generated each time. Thus, the time required for creating the model can be significantly reduced.

Real-time machine models are not only used for HiLS, they are being increasingly integrated into the controller using the increased efficiency of the PC-based controllers, whereby it is possible to simulate the behavior of the machine (e.g., the dynamic behavior) right from the path planning stage and for this to be taken into account in the set point generation. The field of HiLS already offers a multitude of opportunities for reducing the development time and improving the process results. At the same time, it offers enormous potential for increasing the informational value of the simulation results even more. The Hardware-in-the-Loop Simulator “virtual” has resulted from the intensive research activities of the Institute for Control Engineering for Machine Tools and Manufacturing Units (ISW) in cooperation with the “Industrielle Steuerungstechnik GmbH” (ISG). Today extensive model libraries are available which allow simple machine functions (logic, kinematics, material flow) as well as complex, physical phenomenon (mass dynamics, vibration behavior, collision and contact problems, friction etc.) to be displayed in real-time. In these models and the connection over real-time bus systems to the controller, research results and practical experiences of many fields are combined to guarantee a virtual behavior very close to reality. Some “virtual” model examples are illustrated in the title illustration.

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First SERCOS III Conformance Test Certificates issued

At the SPS/IPC/DRIVES show in Nuremberg, Germany, SERCOS International issued the first certificates for conformance-tested SERCOS III products. The testing was executed by the SERCOS testing laboratory at the University of Stuttgart using the new testing tool, the SERCOS III Slave Conformizer.

This consists of extensive test procedures which check the conformance of a device with reference to the SERCOS III specification. In this process not only the correct behaviour of the device in the usual case is tested, but also the error reaction of a slave in case of a simulated wrongdoing of the master. The tests cover the communication protocol, the generic device profile (GDP), and the function-specific profiles for drives and I/Os (FSP I/O and FSP Drive).

The first conformance certificates were issued for products of the following manufacturers:

- Hilscher Ges. für Systemautomation mbH
- HMS Industrial Networks for SERCOS III slave communication module (Anybus-CC)
- Phoenix Contact GmbH & Co. KG for the digital and analogue Block I/O, as well as a bus coupler for modular I/Os
- Wago Kontakttechnik GmbH & Co. KG for a bus coupler for modular I/O
- Bosch Rexroth AG for IndraDrive servo drives

The certified devices may be labelled with the „SERCOS Conformance Tested“ logo, attesting to the high quality of implementation.

SERCOS III Slave Conformizer tool

The SERCOS III Slave Conformizer is provided as a complete test and development environment for SERCOS slave devices. It includes an active development environment for SERCOS slave devices. It includes an active

SERCOS Slave Conformizer tool

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Modular control system with SERCOS III interface

With the SCS 3 control and IO system AUTOMATA introduces a compact and modular device family with SERCOS III interface. Its technical features make the SCS 3 system ideally suited for the automation of modular machines. SCS 3 devices are programmable with IEC-61131 or "C" language. They combine the advantages of a cost-efficient compact control with fast, highly synchronous and safe communication over SERCOS III. The device family comprises several variants: a base unit with two MODULbus sockets for I/O modules (digital, analog, encoder, positioning modules) or additional communication interfaces (SERCOS II, PROFIBUS, CAN, RS232/485), a base unit with fast digital IO’s and a compact operator panel with QVGA display and keyboard. All devices are available with SERCOS III master or slave interface and are equipped with a MicroSD slot to store data and programs, a real-time clock and NVRAM.

www.automata.de

Cabling components for SERCOS III

HARTING has developed a portfolio of cable and components for SERCOS III applications. The user is able to select from a number of mating interfaces, choosing the best fit for the specific requirements. Connecting hardware for IP20 environments, as well as for IP65/67 harsh environments, is available. In addition, pre-assembled system cables are offered that are tailored to the exact length for the application. For example, SERCOS III devices can be networked in a line topology, with the devices installed in sequence, side by side. Depending on the control system, the number of SERCOS III devices can reach several hundred units on one line. A SERCOS III control unit is linked to the slave devices via a system cable. The installed SERCOS III network can be closed to a ring configuration with an additional secondary system cable from the last unit in the line to the control. Following this procedure, operational safety is guaranteed in the case of an interruption of the cabling. HARTING supplies the SERCOS III cables that are used at each mode, even in the most complex demanding systems.

www.HARTING.com

RZA-Ethernet Monitor: A powerful tool for analysis

The RZA-ETM Ethernet Monitor from Distributed Systems Engineering GmbH (DSE) represents a flexible modular platform for customized measurement and testing solutions. The basic features of the Ethernet Monitor are timing analysis and tracing of Industrial Ethernet systems. Based on flexible user-defined trigger conditions, inputs can be captured synchronously to the Ethernet messages. Each received Ethernet packet is tagged with a precise timestamp and can be forwarded to a PC for detailed analysis of both the packet-content and the timing.

DSE provides expertise and skills to support SERCOS III development and integration. In cooperation with SERCOS International and ISW (University of Stuttgart), DSE is in charge of SERCOS III conformance testing. In addition, DSE offers training and consulting during the entire development process.

www.distributed-systems.de

Servo position controllers with SERCOS II and SERCOS III interface

Metronix has developed and produced innovative control technology with a focus on intelligent servo position controllers for more than 30 years. In the last 5 years, Metronix has further expanded its competence in the SERCOS area. Controllers provided with optional SERCOS II interface can be integrated in the fullbus structure as slaves. Thus, a fail-safe, powerful and manufacturer-independent bus technology is available to the machine manufacturer, efficiently supporting highly dynamic automation processes. That’s why servo position controllers with the SERCOS interface are particularly suitable for application in demanding growth markets like solar technology, LCD panel production, wafer handling and production systems for new battery technologies for alternative vehicle drives.

Currently, a real-time Ethernet module that will support SERCOS III and more real-time Ethernet-based standards is being developed. In order to satisfy the continuously growing requirements for shorter cycle times and to support highly dynamic applications in the future, Metronix launches the new ARS 2000 device series. In addition to a considerable performance increase, the new ARS 2000 servo position controller meets the high requirements of the safety technology according to EN 61800-5-2 in modular design. In this connection, support of current communication interfaces like Ethernet/IP and USB is a matter of course.

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Recent development of modular safety

- Current development of Ethernet based fieldbus systems such as SERCOS III
- High Performance
- Support for SERCOS II
- Security for SERCOS III
- Recent development of modular safety systems according to EN 61800-5-2

ARS 2000 News

- Short cycle times down to 31 μs
- 4-times over-current
- High Performance
- Support for SERCOS II
- Current development of Ethernet based fieldbus systems such as SERCOS III
- Recent development of modular safety systems according to EN 61800-5-2

SERCOS III is the basis for the continuous high-performance PacDrive 3 automation bus with integrated safety solution

www.ars2000.com

SERCOS III Seminars available as Webcasts

A seminar with a total of nine lectures about SERCOS III is available as webcasts on the homepage of SERCOS North America. The lectures were recorded in the context of a one-day seminar which was held in Atlanta (USA) in September 2009. The presentations include not only a very good introduction into the subjects of real-time, Ethernet and SERCOS, but also deal with interesting and innovative products, components and applications related to SERCOS III. The presentation material is also available as downloads.

SERCOS intensifies activities in Asia

In Asia, the demand for integrated automation solutions and a greater flexibility in production is continuously increasing. For this reason, SERCOS International is intensifying its activities in the Asian region. Exhibition presence is planned for several trade shows in China and India. Furthermore, SERCOS III related seminars and workshops are scheduled for China, India and Japan. Moreover the cooperation with CAMETA (China Association for Mechatronics Technology & Application), a non-profit organization engaged in the development and fabrication of mechatronic technologies and products, is intensified.

CeBIT 2010 – Show time for Open Source

The “Open Source Automation Development Lab” (OSADL) was represented as one of 15 Open Source initiatives at the CeBIT 2010 in Hanover (3.-7.3.2010). Since Real-time Linux has established itself as standard operation system for embedded systems and industrial automation, now the integration of Real-time Ethernet protocol stacks in the Mains-line-Linux Kernel is driven forward. The realisation of SERCOS III Master Stacks is based on the CoSokja (Common SERCOS Master) library which was released as Open Source software under the LGPL v2.1 license in November 2009. The software is available for download at https://sourceforge.net/projects/cosema.

Weidmüller IE-Line Connectors for SERCOS III

With the appearance of the new wiring guideline for SERCOS III networks, the end user now has clear and defined standards for installation. The defined cable and connectors in this guideline build the basis for secure wiring of SERCOS III applications. Weidmüller has implemented the requirements of this guideline in their IE-Line connectors with STEADYTEC® technology. Starting with 19 inch patchpanels and DIN rail outlets inside the switch-cabinet, right through to sturdy IP67 connectors in the field, Weidmüller offers all infrastructure components for SERCOS III networks. The M12 and RJ45 connectors are characterised by exceptional robustness and the capability of field harnessing without special tools. Fibre optic connectors and cables also complement the range. Weidmüller components are able to satisfy the requirements of even the most demanding SERCOS III application.

www.weidmueller.de

PacDrive 3: Ethernet-based communication

With PacDrive 3, ELAU, a Schneider Electric subsidiary, introduces the follow-up technology for the PacDrive M automation solution that has been successful for more than 10 years. In PacDrive 3, tried and tested methods for reducing engineering, commissioning and service times have been ported to forward-looking technology. Existing PacDrive M projects can be easily transferred. As a Ethernet based, continuous automation bus, SERCOS III forms the basis for integrated safety solutions and ensures that the bus is no bottleneck. Even higher performance with fine scalability mark the range of the new controllers and a modular drive concept for single and multi-axis applications reduces the costs for servo drive solutions. A workbench with all tools for engineering, commissioning and service as well as a multi-user concept, offers space for the design of interdisciplinary project processes.

www.elau.de/pacdrive3
### FAX-RESPONSE

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### Workshops · Fairs · Roadshows · Seminars

#### Fairs
- **Hannover Messe** · April 19-23, 2010, Hannover
- **FA/PA** · May 12-15, 2010, Peking/China
- **swissT.meeting** · June 30 – July 01, 2010, Zurich/Suisse

#### Automation 2010
- Sept. 21-24, 2010, Mumbai/India
- **PackExpo** · Oct. 31 - Nov. 03, 2010, Chicago/USA
- **Industrial Automation Show** · Nov. 09-13, 2010, Shanghai/China

#### Plug Fests
- **FA/PA** · May 12-15, 2010, Peking/China
- **Industrial Automation Show** · Dec. 15-19, 2010, Mumbai/India

#### Seminars
- **Automation 2010** · Sept. 21-24, 2010, Mumbai/India
- **PackExpo** · Oct. 31 - Nov. 03, 2010, Chicago/USA
- **Industrial Automation Show** · Nov. 09-13, 2010, Shanghai/China
- **FA/PA** · May 12-15, 2010, Peking/China
- **Industrial Automation Show** · Dec. 15-19, 2010, Mumbai/India

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**Phone:** __________________________ **Fax:** __________________________

**e-mail:** __________________________ **Internet:** __________________________

**Yes,** I am interested in SERCOS and SERCOS III. Please send me more information.

**Fax:** +49 (0) 7162/9468-66