SERCOS – a future-proof standard:
Broader, deeper, more universal

Additional functions and a broad selection of devices for new applications

**New functions in the application layer for a variety of types of devices, and an ever larger number of controllers, electrical, hydraulic and pneumatic actuators as well as numerous peripheral devices expand the range of SERCOS III applications into a universal network for automation technology. This makes the internationally accepted standard for Ethernet-based real-time communication easier to use in complex applications such as semiconductor manufacturing and in entire production lines in the food and packaging industry.**

The future has a past: Twenty years ago, drive and control manufacturers – one of them Rexroth – as well as other component and system suppliers developed SERCOS as a means to advance the benefits of decentralized automation structures through internationally standardized real-time communication. What nobody dared to hope for back then: Even 20 years later, SERCOS III, the worldwide recognized standard, still uses the same hard real-time mechanisms that have since proven themselves in several million nodes. This goes to show once again that non-proprietary are more stable and long-lived than proprietary systems. The state of the art for demanding real-time communication has been characterized by only three technology generations in two decades. In the third generation – SERCOS III – the proven mechanisms are combined with the Ethernet physical layer, thereby opening up additional areas of application. At the same time, SERCOS is changing from the original drive communication into a universal bus for decentralized and centralized automation concepts.

**Broad spectrum of industrial automation applications**

While in the early stages, the focus was mainly on the requirements of machine tools, newspaper printing presses were starting to take advantage of SERCOS’ high synchronization performance as early as the mid 1990ies. The electronic line shaft developed by Rexroth revolutionized web-fed printing press engineering by enabling the switch to a much more flexible and productive technology using individual drives. Likewise, numerous manufacturers of machines for the food and beverage industry and packaging machines were quick to recognize the advantages of real-time communication and replaced mechanical solutions by software-controlled drives communicating via SERCOS. Software functions such as electronic cam switches, cams, print mark and tension controllers increase flexibility in automation technology and significantly reduce rebuild times.
Currently, engineers developing robots, machines in connection with the manufacture of semiconductors, and complex special applications are working on new concepts with SERCOS III as the universal bus of choice. Aside from the technology's proven long life-cycle and the resulting return on investment – with over 60 companies around the globe supporting SERCOS with controllers, drives using a variety of technologies, and peripheral devices – new functionalities and an expanded range of drives allow for a greater degree of freedom for innovative concepts.

Transparent data access to all drive technologies

Following the electronic drivers, hydraulics and pneumatics are also turning more and more towards digitally controlled modules. This increases flexibility and shifts tasks previously solved by mechanical means to software solutions. SERCOS translates these advances into consistent automation structures. Hydraulic and pneumatic drives using SERCOS interfaces unifying communication across different technologies. The Rexroth Motion Control HNC100 uncouples the hydraulic system from the automated process. It closes the control loop decentrally and automatically offsets the special characteristics of fluid technology. The SERCOS interface allows for transparent data access and opens up all of the benefits of a decentralized architecture for hydraulics applications.

Rexroth also offers SERCOS interfaces for pneumatics. The controller communicates via SERCOS III bus modules directly with valve terminal systems driving up to 32 valve solenoids. User-friendly configurations allow users to easily and efficiently set up the valve terminal systems including communication with the bus. The universally usable system offers endless possibilities, such as flexible addressing of individual participants, or the realization of various electrical emergency-off circuits for pneumatic valves.

New functions in the application layer

At the same time, SERCOS developers are working on increasing process stability and precision through new functions in the application layer. They are also focusing on new applications in robotics and semiconductor manufacturing. One area of concentration: Transmitting more information per clock cycle and event-controlled information independently from the fixed clock cycle.

The new oversampling in SERCOS III makes it possible for the first time to transmit more than one target/actual value per clock cycle. This increases the process control intricacy for instance in extremely time-critical laser applications, because it allows for more data to be collected and...
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communicated at a faster speed. Measurement methods are integrated directly into the protocol, thereby opening up the possibility to access these mechanisms across different manufacturers and independently of the product.

Likewise, time-stamping opens up new communication options beyond the fixed clock cycle. This function is event-controlled, promptly transmitting defined events such as certain measurement values to the controller and switching outputs independently from the clock cycle. This increases process stability for instance in complex solutions such as those needed in semiconductor manufacturing, where controllers tailored specifically to the semiconductor and solar industry, such as the Rexroth Motion Control NYCe4000 controller, process the signals from up to 120 digital and analog I/Os in real-time. Unlike most other industrial production processes, the production of semiconductors requires numerous process steps to be carried out in a vacuum or under inert gas. Automation solutions must therefore simultaneously record, evaluate and react to numerous sensor signals. Oversampling and time-stamping are important additional functions that increase process stability.

Straightforward engineering

In addition, SERCOS simplifies the entire engineering and handling by offering a harmonized and consistent semantic for devices with a modular physical structure such as modular IOs, as well as for devices with a non-modular physical structure, such as drives. This functionally oriented device classification harmonizes engineering and diagnosis within industrial automation. It lets future users and programmers simulate the automation offline prior to going live, which in turn shortens time to market.

Once special feature of SERCOS III: Real-time cross-communication between controllers. It drives modularization in mechanical and plant engineering. The controllers of the various modules and machines have to simply be connected through SERCOS III via an Ethernet cable in order to be able to synchronize and exchange information with each other in real-time. As an example, in the new universal screen printer KAMMANN K15 CNC for direct printing on glass, plastic and metal objects, four controller-based IndraMotion MLC control up to 146 servo drives. This results among other things in a reduction in rebuild times from three to four hours to less than one hour. This provides crucial leverage for productivity especially as order sizes are getting smaller and smaller.
An even more intricate flow of information due to oversampling and time-stamping, and real-time cross communication between controllers point the way: The broad support by many independent manufacturers continues to expand the technical performance and universal applicability of SERCOS on an ongoing basis. As a result, there will be further growth into new applications as the organization enters its third decade.

_Bosch Rexroth AG is one of the world's leading specialists in the field of drive and control technologies. Under the brand name of Rexroth the company supplies more than 500,000 customers with tailored solutions for driving, controlling and moving. Bosch Rexroth is a partner for industrial applications and factory automation, mobile applications and using renewable energies. As The Drive & Control Company, Bosch Rexroth develops, produces and sells components and systems in more than 80 countries. In 2009 Bosch Rexroth part of the Bosch Group, achieved sales of around 4.1 billion Euro with 34,200 employees._

_For more information please visit: www.boschrexroth.com_

**Picture Captions:**

**Picture 1:**

_Semiconductor applications: The broad support by many independent manufacturers continues to expand the technical performance and universal applicability of SERCOS on an ongoing basis._

**Picture 2:**

_numerous manufacturers of machines for the food and beverage industry and packaging machines were quick to recognized the advantages of real-time communication and replaced mechanical solutions by software-controlled drives communicating via SERCOS._