

Fact sheet (part 1): Innovative automation with Industrial Ethernet

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An increasing number of manufacturers are using Industrial Ethernet solutions to implement new machine concepts. The features of SERCOS III are allowing market leaders in the mechanical engineering sector to find new approaches and make innovative ideas reality, overcoming the obstacles posed by the limitations of traditional field busses.

It took around 10 years for the TCP/IP protocol created by Vint Cerf to become the sole official Internet standard, which it finally did on 1st January 1983; it was yet another 10 years before Tim Berner-Lee came up with the basis for a completely new application to make the Internet useful and interesting for everyone. The World Wide Web transformed the Internet from a mere data network into a global information network.

Innovative applications are the key to making full use of new technologies' potential. Nobody switches their technological platform if the new one offers little improvement to the old. Yet even once a technology has been launched, it takes a while before enough components are available and engineers have got to grips with the new possibilities the technology offers. Once ideas and components are available, the time is ripe for the next stage in technological development.

It should therefore come as no surprise that Industrial Ethernet solutions have not replaced traditional field busses overnight. The technical benefits are obvious, but they do not automatically render functioning systems obsolete. The fact there is a wide range of competing solutions all aimed at using Ethernet technology for mechanical engineering does not make the changeover any easier. Users and developers must weigh up the pros and cons with extreme care. How many providers support a particular solution? How clearly defined are the standards? Does a solution cover all areas of application or has it been optimised for one particular field? How much influence can single providers have on future developments?

There was a time when the Industrial Ethernet was seen as some far-off, possible unachievable development. Now, however, a new trend is emerging: manufacturers and users have become familiar with the new technology and are working on the practical implementation of innovative machine concepts, making full use of the advantages of Industrial Ethernet. Pilot applications have been up and running for some time, but the number of drives and controls actually available has risen noticeably since 2006. This provides the basis leading providers need to work on the next generation of machines. Many market leaders are choosing SERCOS III as a platform for a targeted entry to the Ethernet world.

One example is the Dürr Group, a leading international provider of products, systems and services used first and foremost in the automobile industry. Dürr's products include efficient, highly-automated painting plants; in future, these are to operate on the basis of Industrial Ethernet. "This is a technological quantum leap for us", says Dr. Alexander Meissner, Head of Control Technology Products at Dürr Systems GmbH. "To date, we have been using two busses in parallel to ensure the secure

transfer of motion and process data. With Industrial Ethernet, not only do we just need one cable for both, but we can also reduce cycle times and diagnose problems with much greater accuracy.” The large number of axes in a painting system means that the data throughput of a standard field bus is no longer enough to meet Dürr’s requirements.

“We have been looking at Ethernet solutions for some time now: we would like to use much more data in our operations and, at the same time, work with even greater rapidity and precision,” explains Alexander Meissner. “A faster bus also allows us to react more effectively to any events.” Dürr is therefore now working on an intelligent diagnostic tool which “doesn’t just send the shift manager a fault message at 3 in the morning, but also shows him which valve won’t open.” The precise localisation of faults reduces machines’ idle time, a considerable advantage for users.

“We send motion and process data via one bus in parallel, and we therefore require great reliability and excellent performance. Another decisive criterion is real synchronism so that we can optimise processes,” explains Meissner. “That is why we have opted for SERCOS III, which fulfils all three key requirements.”

The real-time Ethernet solution SERCOS III provides a data throughput of 100 Mbit per second and cycle times of just 31.25 µs (it takes approx. 330,000 µs to blink). The integrated communication chip makes direct communication between the operating units possible and replaces expensive control units in the network such as hubs and switches. The SERCOS drive profile has been standardised with the IEC standard 61491 since 1995. As Industrial Ethernet develops, IEC 61800-7 (drive profiles) and IEC 61784/61158 (industrial communication networks) are now becoming increasingly important. This standard also sets out the tried and tested drive profile on which all three generations of SERCOS are based as well as the SERCOS real-time protocol. A certified safety protocol guarantees secure data transmission for sensitive information.

“Simplifying the safety functions is one of our key objectives,” says Andreas Birkenfeld, Head of System Technology Construction at Koenig & Bauer AG (KBA). KBA manufactures high-performance roll and sheet-fed offset printing presses. Great precision and coordination of the presses’ rapidly rotating axles is vital in the application of ink. “Security is a great priority for us; in practice, this meant that we had to operate several data paths in parallel,” explains Andreas Birkenfeld. “With the SERCOS III certified safety protocol, we only need one cable and just one programming level for all functions. This is a great help in development: it both improves quality and reduces expense.”

Under the new machinery safety standard EN 13849, manufacturers will as of November 2009 have to prove the functional safety of machines whose security functions depend on controls. This is now leading to a greater need for documentation. “We have already invested thousands of hours in having our existing systems certified in accordance with the standards,” says Birkenfeld. “Integrated safety makes this process significantly easier.”

KBA already uses SERCOS II in its printing presses; the switch to the third generation of SERCOS is therefore not a hard one. Existing motion control profiles can remain in use and be rapidly adapted. The company is also expecting to reap further benefits from direct communication between units, and from the Ethernet copper wires which are less subject to aging in a printing press than the light-emitting diodes in optical fibres.

Whilst KBA is introducing Industrial Ethernet on a step-by-step basis, ROVEMA Verpackungsmaschinen GmbH has opted for a full and complete change of technology. “We are switching all our machinery to SERCOS III,” reports Erhard Lutz, Head of Electronics Development at ROVEMA. The company used analogue controls in the core systems and now completely skips the field bus stage. “We are taking the plunge, and switching immediately and completely to a modern and future-proof bus system,” says Lutz Erhard. “We are not just doing this for the sake of it: our customers are not interested in the details of how our plants operate as long as they provide the required performance and reliability.”

Over 25,000 ROVEMA packaging plants and machines are in use around the world. The requirements for a new technology which must fulfil the highest of quality standards are therefore extremely demanding. “There are many advantages in one standardised and consistent interface up to digital I/O and down to each individual motor,” says Erhard Lutz, summing up the benefits. “Installation is much easier, we have new diagnosis options and can send data around the world with TCP/IP.” ROVEMA looked at a range of Industrial Ethernet solutions and finally decided in favour of SERCOS III because of its reliability, consistency and the clearly standardised protocols and profiles.

The rapid bus system makes it possible to monitor packaging machines more closely, for example if a sheet sticks in a tubular bag machine and the intended content falls into the sealing device. SERCOS III makes rapid product scanning possible; this

prevents the item heating up and thus makes cleaning easier. What is more, the personnel can be informed of the problem directly so that it can be dealt with quickly. "A rapid bus with all the communication potential Ethernet offers opens up a whole new world of monitoring and maintenance options," says Lutz.

As the above examples demonstrate, the market is now taking off. Industrial Ethernet has reached the critical mass needed to prove its worth not only in special applications, but in the market as a whole. Investments by leading mechanical engineering companies on the market are showing that rapid, real-time Ethernet solutions can make new concepts possible, concepts which offer clear increases in customer benefits. The breakthrough which took over 20 years for the Internet will this time be a much more rapid one.

Please note: There are four parts to the Information Service; each deals with a different aspect.

Part Topic Date of publication

- 1 Market leaders use SERCOS III in innovative machine concepts November 2008
- 2 One cable is all you need: greater efficiency and cost effectiveness January 2009
- 3 The multiple benefits of open standards for factory automation February 2009
- 4 The benefits and risks of open source solutions in production March 2009

SERCOS International (SI) is an association of users and manufacturers responsible for the technical development, standardisation, certification and marketing of the SERCOS interface real-time data transfer standard. Over 2 million SERCOS nodes are currently in use in over 350 thousand applications across the world. Conformity tests ensure that the SERCOS interface is implemented in accordance with the standard and that devices from various different manufacturers can thus be used in combination. A further increase in speed is not all the third generation of SERCOS offers: CAT 5 copper cable can now be used as well as optical fibres. The new generation also transfers data packages in accordance with the TCP/IP protocol on which the Internet is also based. A wide range of security functions and secure full-duplex operation ensure smooth real-time operation. The organisation, based in Germany, currently has over 70 member companies worldwide and has branches in North America and Asia.

Further information is available at: www.sercos.org

Author:

Bosch Rexroth AG
Daniel Grimm
Head of Marketing Working Group, SERCOS International

For readers' enquiries:

Tel.: +49 9352 40-5245
Fax: +49 9352 40-35245
E-mail: daniel.grimm@boschrexroth.de

For journalists:

Tel.: +49 7162 9468-65
Fax: +49 7162 9468-66
E-mail: p.lutz@sercos.de

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