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ETHERNET



POWERLINK

FACTS

The Magazine for the Standard
in Industrial Ethernet

Ahead in ten fields: serial champion POWERLINK

Simpler Machine Design

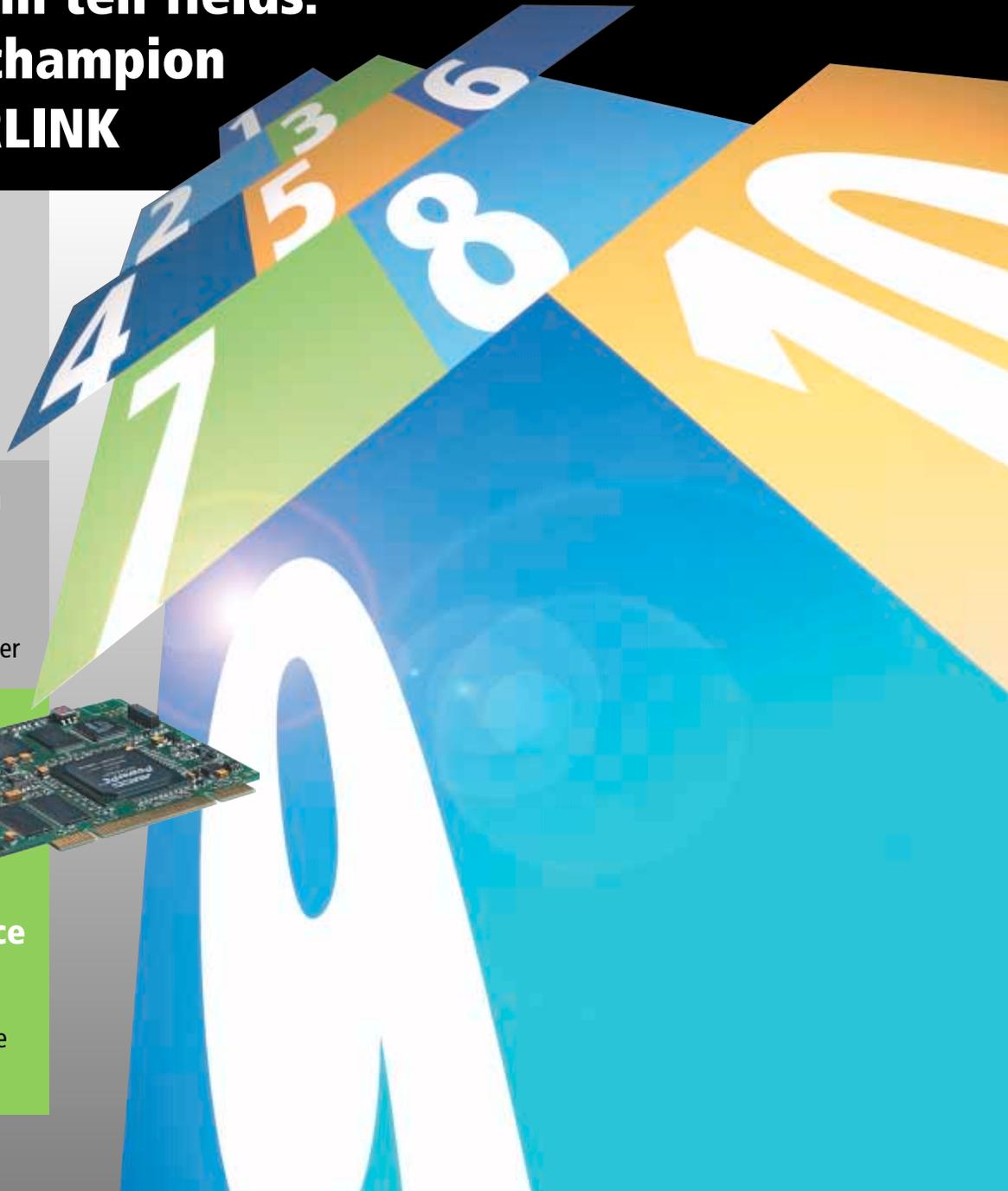
Baldor enhances
Design Freedom
for Engineers

Connection under Control

Hirschmann's
POWERLINK router



**High
Performance**
POWERLINK PCI
Interface incl.
Software Package
from Janz



Time to show your colors

28,000 POWERLINK-enabled series machines make this real-time standard the undisputed market leader in the Industrial Ethernet arena. In acknowledgment of that fact, the EPSG – Ethernet Powerlink Standardization Group – has decided to relaunch the POWERLINK brand design and refocus the professional public's attention on the technology.

"It is imperative that we fly our flag now, and demonstrate to our members as well as to the market that POWERLINK has been a major success story up until the present day", says EPSG Chairman Dr. Edwin Kiel, when asked to explain the step the group has agreed to take.

Andreas Enzenbach, Head of the EPSG's Marketing Working Group, weighs in with his comment: "The new design's recurring color bar is meant to illustrate that POWERLINK rests on many different shoulders. A system which may well be called **the open standard** would be inconceivable without the members of the EPSG."

The color bar in the POWERLINK logo is a visual symbol for the EPSG member community. Six different colors exemplify the diversity of – at the time of writing – more than 400 members, supporters and users who supply POWERLINK-capable products and provide services related to POWERLINK technology. This color bar will figure prominently in all means of communication employed by the EPSG.

Not only will POWERLINK be present with an all new stand in Hall 15 at the forthcoming Hannover Messe 2007, but a print advertising campaign will be launched at the same time in all major trade magazines, with one single objective: to communicate POWERLINK's crucial benefits and technical features.

After its two issues in 2006, **POWERLINK FACTS** has now changed its layout as well to reflect the new brand design.

Hannover Messe 2007 also marks the occasion of the transfer of the EPSG Office to FR&P Werbeagentur in Berlin, the agency now in charge of the group's new overall corporate communication concept.



www.ethernet-powerlink.org

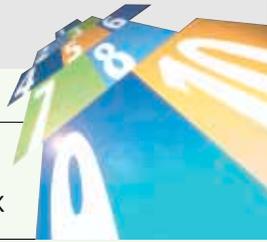
ETHERNET POWERLINK

*The symbol for the successful cooperation of more than 400 companies:
The new POWERLINK logo*

Welcome: The POWERLINK Center at Hannover Messe 2007



*10 unbeatable arguments:
The POWERLINK print campaign 2007*



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Open and independent

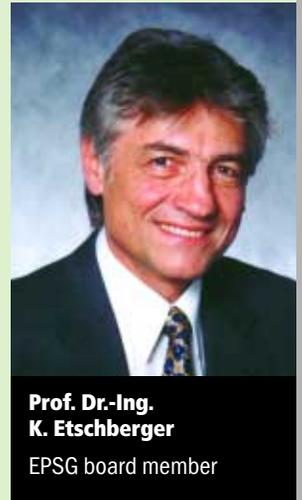
Of course, POWERLINK is not the only deterministic Ethernet protocol that can be used to implement a real-time Ethernet solution. But POWERLINK is the only protocol not bound to rely on specific hardware properties to meet hard real-time requirements. Combining tried and tested technologies (Ethernet, CANopen) and a software-based implementation concept, it is a completely manufacturer-independent solution.

Since it adopts characteristics that have made the CANopen standard a global success, the POWERLINK concept provides a comprehensive functionality to implement distributed automation systems.

Due to its total openness, however, POWERLINK can also very easily be integrated into open hardware technologies such as FPGAs, a solution that is e.g. available from IXXAT. One of the benefits of this approach is that it allows for a very simple and cost-efficient implementation of a POWERLINK interface. In addition, the FPGA software can optionally be replaced to implement other protocols on the same hardware base.

We welcome your visit to the all new POWERLINK center at the HMI 2007 exhibition, and would like to invite you to get your own impression of the dynamic development POWERLINK has undergone – for instance, regarding safety features and enhanced reliability for data communications.

Prof. Dr.-Ing. K. Etschberger



**Prof. Dr.-Ing.
K. Etschberger**
EPSG board member

Ahead in ten fields: serial champion POWERLINK

Various arguments determine how a communication standard is selected. Which ones are more significant than others is subject to change and lies in the eye of the beholder. Some users may scrutinize three or four aspects, while others may single out seven or eight. However, POWERLINK leads the field of real-time Ethernet technologies in as many as ten criteria, which will be detailed here step by step.

■ Criterion 1:

Development advances

Users do not care how advanced a development is, as long as the product concerned is not yet available on the market. The only relevant development advances are those that come after the launch of series production. POWERLINK series products were first supplied in 2003, which safely reassures customers that this bus standard is a proven technology which has been applied in the field for a number of years. Due to these years of experience, the mature specification can also be relied upon to meet all typical demands, as the system has long been thoroughly adapted to new requirements from real-world applications. Hence, POWERLINK is a prime example of user orientation today.

■ Criterion 2:

Independence due to openness

To depend on someone always means to surrender some measure of control to others, too – anything but an ideal starting point for the development of technologies that have strategic importance for your company. Second source availability is therefore often a

make-or-break issue for strategic decision makers. Due to its open structure, POWERLINK ensures you will find second sources for almost anything, including new developments, faster than for any system that is proprietary in nature. POWERLINK is a kind of fieldbus operating system which runs on standard Ethernet hardware. Notably, it works like an open operating system – its communication mechanisms are standardized, but actual software implementations can be released and maintained by anyone in their own right. A number of software houses provide entry-level tools to facilitate quick product implementations.

■ Criterion 3:

Keep using existing technologies

A great many machine and plant engineers use the CANopen fieldbus standard today – for years, major investments have gone into this technology, which is renowned for the high functional quality it has achieved. Since it integrates the CANopen standard (by adopting EN 50325-4 standard device profiles), POWERLINK opens up a highly comfortable migration path for CANopen users to enter the Ether-

net world. E.g. drive developers can resort to the CANopen-DSP 402/POWERLINK combined standard and very quickly use the new protocol with their devices. And, by the way, the POWERLINK V2 protocol revision is by no means the first to be CANopen compatible. “All POWERLINK systems in use today support the CANopen standard. In existing applications, users will not notice a difference between the protocol versions V1 and V2, since, after all, V1 installations do not require any of the more recent CANopen device profiles”, says EPSG board member Anton Meindl.

■ Criterion 4:

High speed just like in the office world

POWERLINK users can easily boost network performance by a factor of 10. Changing the hardware platform to include 1 Gigabit hardware instead of 100 Mbit components is all any developer must do, resulting only in a somewhat different list of components to be fitted onto an otherwise identical PCB. How is that possible? Since POWERLINK is based on standard Ethernet, it benefits very quickly from development advances made by

thousands of manufacturers worldwide who make products for the office market and strictly observe downward compatibility. Proprietary Ethernet solutions, on the other hand, need special hardware components (ASICs) which often require a much more protracted process of development and testing.

■ Criterion 5:

Market acceptance

References are always called for, especially when there are no readily available solutions for a given application's requirements, since these are the cases where a partner must be trusted to provide an ideal solution. Obviously, potential partners with a track record of solving similar problems in other applications are, so to speak, likely to receive an advance in trust. And POWERLINK's list of references is, indeed, truly extensive: across the world, over 28,000 series machines from more than 400 machine manufacturers are currently operating with “POWERLINK inside”. That equals 210,000 nodes in everyday operation – which should suffice to instill all the necessary confidence in anyone who wonders if POWERLINK is a feasible choice.



■ Criterion 6:
Safe error handling

POWERLINK Safety Technology ensures safe data transfer across networks between nodes of a safety domain. It is suitable for SIL 3 compliant machines and plants. The IEC 61508's definition of this Safety Integrity Level dictates that no more than 10^{-9} errors per hour may occur. In other words: a dangerous condition may be caused by a bus fault only once every 115,000 years on average. In addition, POWERLINK systems can also be set up for high availability. This is the rule e.g. in power plant applications, where precautions against malfunctions are part of the plant design and redundant components are therefore installed. There are e.g. two control systems of which only one is active. The second system monitors all events and communications in standby mode. If the active controller fails, this backup system immediately assumes its function. Since there are also two separate POWERLINK lines, all bus nodes can communicate via the alternate line if one cable is damaged.

■ Criterion 7:
Network topology of choice

Star, tree, line – POWERLINK supports all options. You can integrate your machines, plants and process automation components into a network without any restrictions and with different levels of redundancy. Systems using a redundant ring topology, on the other hand, often run into



a problem when a node is added: between which two devices should the "new box" be inserted? Sooner rather than later, it becomes hard to say which cable connects exactly which components on the ring. That can turn into a pressing problem for error recovery procedures. Also, in case of line failures (cable breaks), these systems will usually need a full data cycle before the master receives the data via the other route along the ring. POWERLINK just drops a frame – and carries on. Even while an error is occurring, POWERLINK's intelligent redundant set-up continually ensures that any data set remains fully available at any point on the network, virtually at any time.

■ Criterion 8:
Direct cross-traffic

Direct communications between two intelligent systems are always the fastest and easiest way to transfer data. Think of the CC function when composing an e-mail: if it is used for everything all the time, the better part of the recipients will just be drowned in a pile of information they do not

need, but have to screen, sort out and discard. POWERLINK does not need to send such circular letters. Given decentral control structures, you may instead use cross-traffic – which means Master-independent communication – and thus choose the more efficient direct route. CANopen users are already familiar with this feature. POWERLINK systems ensure that data communications on the bus adhere to a cycle time that can be exactly predicted. It can easily be calculated with an Excel spreadsheet during the planning of a POWERLINK-enabled automation network.

■ Criterion 9:
Low hardware costs

What are the benefits of a software-based solution? One is paramount: it runs on more or less any hardware – in contrast to proprietary technologies which require special ASICs. POWERLINK's software approach therefore saves costs, as hardware operating in a POWERLINK network may generally be used with other protocols as well, at any time. In addition, POWERLINK is also cost-efficient because standard

diagnostic and measurement systems from the office world can often be used for service and maintenance tasks on the industrial network.

■ Criterion 10:
Hot Plugging

A well known feature in home and office environments, plugging a network line into a laptop is all it takes to enable communication with shared devices. Removing the connector again will usually not compromise the stability of the network as a whole. POWERLINK implements this feature even more reliably. Its dynamic configuration ensures that nodes can simply be replaced, removed from or added to the network with no need to halt an application. Not only does that simplify diagnostics, debugging and error recovery, it also allows for replacing extra aggregates on a machine while it is running. The bottom line is: POWERLINK even facilitates implementations of totally new machine concepts.

 www.ethernet-powerlink.org



ECKELMANN AG: CNC, PLC and Motion Control system with POWERLINK interface



Featuring a high-performance MPC5200 PowerPC processor, memory expansion capability (SD card), more fieldbus interfaces (4x CAN, 1x real-time Ethernet) and additional communication ports (USB, RS232C), Eckelmann's ExC66 is designed for demanding CNC, PLC and Motion applications. The most powerful controller model includes a POWERLINK interface for drives and intelligent I/O modules. A universal hardware platform, the ExC66 is suitable for Eckelmann's tried and tested software libraries, which also

include the necessary HMI functionality:

- ELC66 (PLC) with IEC 61131-3-compliant programming tool CoDeSys
- EMC66 (Motion) with additional Motion library (up to 64 axes)
- ENC66 (CNC) with NC operating system, standard HMI for PC and DIN programming (up to 12 axes)

 www.eckelmann.de

Institute of Embedded Systems (InES) at ZHW: The real-time Ethernet innovators

The Institute of Embedded Systems (InES) at the University of Applied Sciences Winterthur has, over the last five years, become a major force in the development and propagation of communication technologies for industrial applications, and for real-time Ethernet technology (RTE) in particular. InES is one of the founding members of the Ethernet POWERLINK Standardization Group. InES has made major contributions to the promotion of POWERLINK technology by publishing articles, speaking at industry conferences, holding training seminars and last not least developing key enabling technologies. These include e.g. the first software stacks and measurement technology such as the High Resolution Timing Analyzer. The Institute was also first to demo a POWERLINK redundancy solution on the POWERLINK PCI card MultiNET. The innovative powerhouse is currently about to launch both hardware and software solutions for the two high

availability protocols Media Redundancy Protocol (MRT) and Parallel Redundancy Protocol (PRP).

Innovations for demanding applications

Due to extensive know-how for real-time Ethernet solutions, and notably for POWERLINK, InES is a highly valued development partner for companies trying to implement particularly innovative approaches to solving demanding applications. InES is always willing to take on new projects of this kind in cooperation with interested industry partners. Successful past projects include e.g.:

- synchronization of multiple POWERLINK network segments,
- the POWERLINK to POWERLINK bridge,
- SoC solutions with MicroBlaze,
- Flying Managing Node solutions for modular machinery.

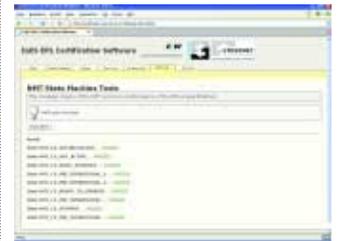
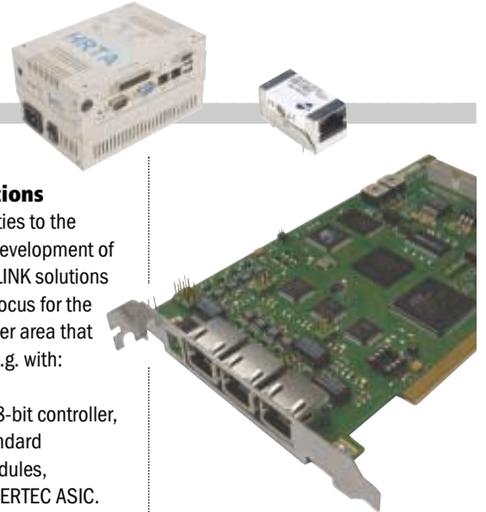
Cost-efficient POWERLINK solutions

InES maintains close ties to the industry. Hence, the development of cost-efficient POWERLINK solutions has become a major focus for the Institute. This is another area that InES has pioneered, e.g. with:

- POWERLINK on an 8-bit controller,
- POWERLINK on standard communication modules,
- POWERLINK on the ERTEC ASIC.

Conformance Test Laboratory

As one of the leading scientific institutions in the field of real-time Ethernet measurement technology, InES is currently the sole provider of POWERLINK conformance test services. The conformance test specification software was also developed in-house. The PowerConform tool, which is available for purchase, enables manufacturers to pre-test their devices before sending them in for compliance testing.



 www.ines.zhwin.ch

IXXAT: Fast entry to the POWERLINK world



IXXAT's new starter kit includes a Controlled Node, which consists of a base board with a POWERLINK FPGA module and a Phytex microcontroller module, a Managing Node PC card and all necessary software packages and drivers needed to quickly implement POWERLINK systems. The Controlled Node supports data transfer via digital inputs and outputs as well as analog I/O ports. The POWERLINK FPGA module serves as a universal interface for the microcontroller module on which slave applications can be developed. The host API for the FPGA module is supplied in C source code with the kit. Device manufacturers can integrate IXXAT's

POWERLINK FPGA module or the hardware design directly into their own circuits. If the host API and one of various evaluation modules from Phytex (XC-161 or LPC2294) or Spectrum Digital (TMS320F2812) are used, the base board therefore allows for developing customer-specific applications before the actual target hardware is available. The base board also features connectors for any manufacturer-specific microcontroller with an SPI or 16-/32-bit memory bus interface. The PCI card supplied as part of the starter kit can be used to implement a Managing Node. Custom Windows-based applications capable of exchanging data with the POWERLINK module or other POWERLINK devices can thus be created based on the Windows driver API also included in the kit.

 www.ixxat.de

POSITAL: Absolute encoders with automatic POWERLINK protocol switching

Part of the tried and tested OPTOCODE series, POSITAL's POWERLINK absolute encoders are perfectly suited for operation in POWERLINK networks and can be very easily included in automation applications. Their integrated POWERLINK interface automatically adjusts for the protocol in use. Both the older version and the current open variant of the protocol are supported. The devices are equipped with a dual port hub, so daisy chain cabling in a cost-effective line structure can be

maintained. However, alternative wiring topologies can also be implemented. The encoders are especially suited to highly dynamic applications such as synchronized shafts and to tasks with high bandwidth requirements. All types are equipped with standard M12 plugs. Their rugged design ensures reliable operation even under harsh environmental conditions. Diagnostic LEDs signal the network status (Link, Collision, Receive) and indicate the POWERLINK device status. Configuration is very simple: The device IP address is set by two turn switches on the interface unit, thereby assigning a network address to the encoder. Device replacements do not require any new configuration effort since the actual encoder can easily be detached from the interface unit.



 www.posital.de



ETHERNET Powerlink:
• complete freedom of control architecture

ETHERNET Powerlink:
• simpler engineering
• reduced control hardware, cabling and assembly

Baldor:
Simpler machine design
POWERLINK motion control range
signals greater design freedom

Three-phase AC drives are Baldor's latest addition to its portfolio of motion control components compatible with the real-time POWERLINK protocol. Also including single-phase drives, a motion and machine controller and development tools, the comprehensive range provides all major motion control functions and opens up new design opportunities for machinery OEMs. Baldor's control platform can improve performance substantially, while simultaneously simplifying the control architecture and reducing costs.

"Machine builders are definitely sold on the system building benefits of the architecture. For each drive node, I calculate that a single Ethernet CAT5e cable eliminates somewhere in the region of 40 to 50 cable stripping, soldering and assembly tasks, for example. Ethernet now accounts for the majority of our sales enquiries, and the completion of the range with three-phase drives opens the technology to almost all machinery OEMs," says David Greensmith of Baldor.

From its first 18 months' experience with Ethernet motion, Baldor has

proved the technology to be very attractive in the multi-axis systems arena. The savings come mainly in the area of simpler engineering, and reduced control hardware, cabling and assembly.

The introduction of 3-phase AC drives means that users can build all-Ethernet systems with the optimum choice of motor technology for each axis, from small to large loads. Rotary and linear versions of brushless servo and AC vector motors are all software selectable.

Many machine builders are trying to move to all-electronic architectures, to provide software-centered, highly reconfigurable systems. Baldor's Ethernet technology is particularly beneficial for this, as its single controller can manage many different machine control components such as I/O, absolute encoders, POWERLINK DS402 positioning drives, stepper motors, as well as up to 16 interpolated axes. As one example of the potential of this control, machine builders could replace pneumatic actuators with stepper or servo motors for instance with no increase in controller hardware – eliminating the costs and issues associated with maintaining a supply of compressed air.

■ **Architectural freedom**

The Ethernet technology does not force a machine builder to adopt any particular control architecture. Systems can still have the traditional central controller if preferred – coordinating all drives in profiled torque, speed or position modes. However, these axes can also be self-controlled positioning devices (DS402 compatible positioning drives) which consume little central processing overhead. In addition, intelligent (programmable) drives can

be employed in a system to implement more complex standalone axes, or to implement the complete motion system. POWERLINK lends itself perfectly to all these scenarios, with the same network manager controlling any type of architecture as described above, or any mix of these. The sheer bandwidth of the network also simplifies machine building. Functionality normally reserved for the device service port – such as firmware updates, configuration and diagnostics – can all be communicated via the common network. Applications can be implemented using two flavors of Ethernet. The POWERLINK protocol provides deterministic performance that makes its suitable for handling the most demanding motion tasks, as well as a means to link seamlessly with standard Ethernet networks. An alternative is the use of standard TCP/IP protocols, which can be suitable if the automation in question does not have any demanding time synchronization or multi-axis coordination considerations. Free ActiveX tools provided as part of Baldor's development environment make it very easy for developers to create Windows-based PC applications that can communicate with the motion hardware via Ethernet.

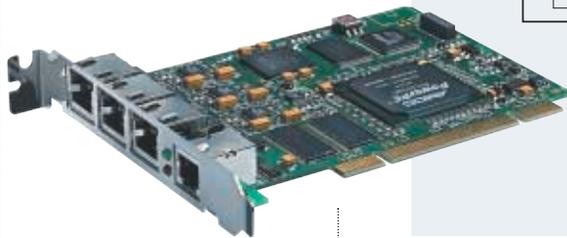
Janz Automationsysteme: High performance POWERLINK interface

Janz Automationsysteme AG's POWERLINK PCI interface is the ideal solution for integrating host systems into POWERLINK automation environments. Plugged into a free 32-bit PCI slot, the interface enables communication with either one or two POWERLINK networks, depending on the performance the application calls for. The POWERLINK communication profile is fully processed by the integrated CPU on the interface card.

The Windows 2000/XP (embedded) and Linux operating systems are supported; support for other operating systems (VxWorks, QNX etc.) is available on request. The POWERLINK protocol stack is compatible to Janz's CANopen protocol stack. Interfaces for other system architectures such as PC/104+ or PMC are designated for development.

A software package now available for Janz Automationsysteme AG's own POWERLINK PCI card greatly simplifies

the development of individual POWERLINK applications. The POWERLINK protocol is in large parts based on time-critical procedures. The protocol handling is therefore managed in firmware by an integrated processor, i.e. directly on the circuit board, which causes no load on the host system. Janz's Software Development Kit

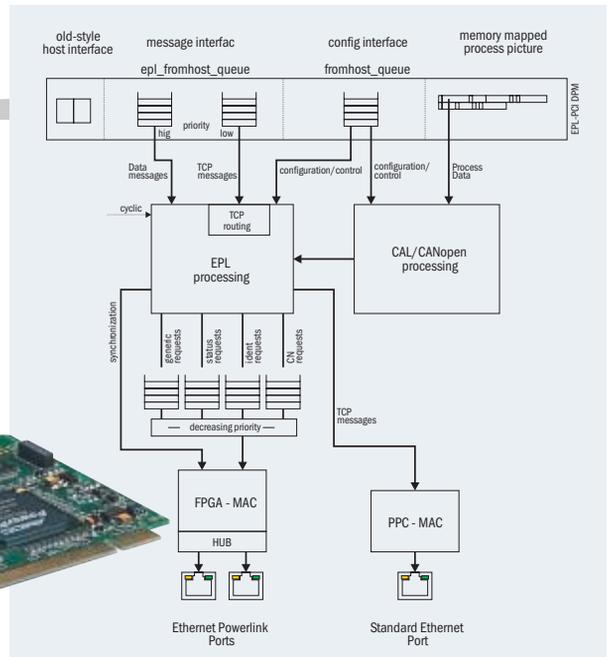


(SDK) provides drivers and libraries containing the API needed for node and network configuration as well as for the data transfer capability. Starting up a network and the nodes on

it requires only a few function calls. The application can then turn to the actual tasks at hand. Process data can be accessed directly in the main memory. Callback functions are used

to provide the application with asynchronous information about events and fault situations.

 www.janz.de



Weidmüller: Secure contact – IE-Line Ethernet connector range

Weidmüller's new IE-Line range of Ethernet connectors features crucial benefits: the products allow for tool-less custom configuration, accommodate 8 wires and provide Gigabit capability (Cat. 6), and are suited for cables up to AWG22. They are supplied in the three IEC 61076-3-106 (V.1/4/5) housing types and can additionally be fitted with different inserts for copper or fibre optic cabling. This modular design ensures a high degree of flexibility in the planning and installation



phases. **STEADYTEC** technology is integrated to provide for easy assembly, speedy data transfer and a robust design to withstand rough industrial environments, all in all yielding excellent reliability during operation.

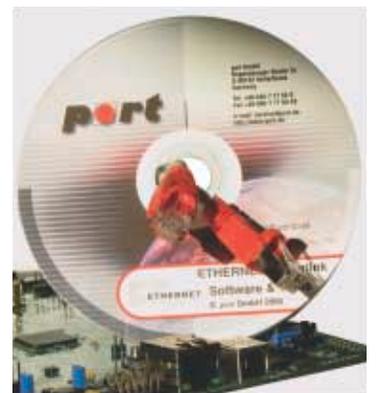
STEADYTEC - Clever, flexible, modular - the Ethernet connector system by Weidmüller

 www.weidmueller.de

port: EPL library / advanced tool set

port's "EPL Networking Solutions" product line enables users to accomplish time-saving, cost-effective and most notably standard-compliant POWERLINK implementations, something almost impossible to achieve without proper software tools. At the core of the suite is the EPL Protocol Library, which was developed based on CANopen-related experience. Major portions of the POWERLINK Library are hardware independent to enable its use on different platforms. Optimized to facilitate POWERLINK implementations, port's protocol-specific development tools support users throughout all phases of POWERLINK device development: in the development phase, the EPL Design Tool ensures the consistency of the implemented functionality through database-oriented management of the project configurations and device data

that are created. The EPL Device Monitor and EPL-REport software tools also simplify device development and provide functions for the configuration, start-up and integration of devices and networks.



 www.epl-tools.com



B&R: The First Open Safety Protocol for Real-Time Ethernet



B&R's Safelogic

Current safety solutions are often based on hardware components that have to be wired separately from the control network, which results in cost-intensive cabling and very limited diagnostic capabilities. Other solutions rely on a safety controller, which receives all signals either directly or via a proprietary safe bus. Systems of this kind require special cables and safe bus components, which again incurs extra costs.

A third, innovative solution developed by B&R resolves the problem: POWERLINK Safety Technology. POWERLINK safety mechanisms, which are laid open, are fully implemented into the data transfer process to enable safety-related data communication via a standard fieldbus. This approach means that safety is totally integrated into the control system, with no need for special wiring – yielding major cost

savings. As specified for IEC 61508 SIL category 3, all relevant standards on safe data transfer pertaining to the automation industry are observed.

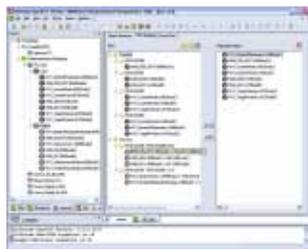
POWERLINK Safety Technology is transport protocol independent, i.e. it is fully compatible with other fieldbus systems such as CANopen. POWERLINK provides a range of benefits due to its high performance and flexibility: it reduces the wiring effort, prevents faults, provides real-time capability and delivers ten times faster response times.

 www.br-automation.com

infoteam: PowerMAP for CANopen and POWERLINK

Supporting both POWERLINK as well as CANopen, infoteam's software tool PowerMAP enables a manufacturer-independent, efficient configuration of fieldbus systems. Components can be configured with PowerMAP using either standardized device description files or the devices themselves.

PowerMAP is compatible to current ASCII formats (EDS, DCF) as well as XML (XDD, XDC). The set-up of new projects is a matter of only a few mouse clicks; for existing hardware, a bus scan will do as well.



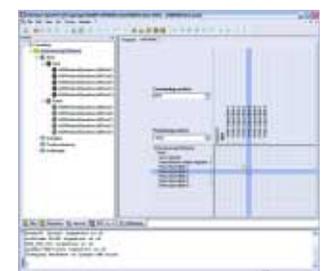
PowerMAP is designed to interoperate with infoteam's OpenPCS Automation Suite. The template concept enables users to store typical constellations and reuse them later. Individual nodes are configured from a tree view panel which provides access to all parameters of the devices on the network.

PowerMAP's key features at a glance:

- Fieldbus configuration for distributed POWERLINK-I/Os
- CANopen compliant
- manufacturer-independent
- integrated HTTP server functionality

Initially supplied as part of the OpenPCS Automation Suite, PowerMAP combines IEC 61131-3 compliant

programming for different platforms with fieldbus communication solutions. Communication stacks for CANopen and POWERLINK are optionally available. Notably, though, PowerMAP does not depend on protocol stacks from hardware manufacturers, but also works with all other implementations that adhere to the standard. The software's function blocks for POWERLINK, which are the same as the familiar, tried and tested CANopen functions in OpenPCS, far surpass the features of the DS405 standard. Like all components of the OpenPCS Automation Suite, PowerMAP can be easily detached from the Suite and embedded in other OEM specific applications, given the sole condition that the target environment supports one of the well-established component technologies (COM/ActiveX, .Net/C#-Controls, Eclipse).



Using PowerMAP in conjunction with IEC 61131-3 allows for linking network data to existing IEC variables or using it for new variable declarations, all with a few mouse clicks. Thus, applications can be adapted to different fieldbuses very simply by swapping a declaration file – without any changes to the program code itself.

 www.infoteam.de

Lenze: Frequency inverters communicate via POWERLINK

Lenze's 8200 vector series
of frequency inverters



Lenze's new, plug-in communication modules for POWERLINK enable the tried and tested 8200 vector and 9300 vector frequency inverter series to use the fieldbus technology of the future.

POWERLINK-based control systems facilitate the implementation of cost-effective and reliable solutions for a wide variety of drive tasks. 8200 vector series frequency inverters are available in a power range from 0.25 to 90 kW in eight different types of housings. Lenze has taken care to stick to a compact "booksize" format, so limited cabinet space is put to maximum use. The Hameln drive and automation specialist shows heat dissipation loss in control cabinets a red card with its "push-through design" and "cold plate"

cooling concepts. For more power-hungry applications, the 9300 vector series covers a power range up to 400 kW.

■ Daisy chain networking

The POWERLINK module is suited for both product families. It features an internal hub and an external 24 V energy supply. Thus, daisy chain line structures can be set up: if a controller has to be replaced or current is inter-

rupted, the installation as a whole maintains its communication capability. The connector sockets on the communication module have been installed at a 45° angle. This design ensures that all IP20 Ethernet connectors commonly used in the industry fit into these ports. The benefits: no cable bending radius eats up space in a control cabinet, and no special angular Ethernet connectors are needed either. An LED row signals the module and bus status for diagnostic purposes. Cabling errors can therefore be identified at a glance.

Besides the POWERLINK module just described, other communication interfaces can be supplied as well, for classic fieldbus systems such as CANopen or PROFIBUS.

■ Comfortable commissioning

Both series of frequency inverters feature a simple start-up procedure, so all inverter models can be comfortably parameterized in little time. The free "Global Drive Control easy" PC software provides adequate operation and parameterization functions to that effect. The software's start-up assistant makes automatic presets in an inverter. Users are only prompted for parameters which directly concern the process. Any non-default values are easily determined in the course of

this procedure and can be stored in the control system (e.g. B&R Automation Studio). If a controller is replaced, there is no need to run a parameterization program again, so a machine can quickly and flawlessly be started up again to return to regular operation.

The inverter features one communication and one function interface throughout the whole power range. The modular design of the series permits expansions of an inverter to provide up to six digital and two analog inputs. Lenze supplies two types of function modules for



POWERLINK module

this purpose: Standard I/O and Application I/O. The former has four digital inputs, one analog input and one digital and analog output each. The Application I/O module provides six digital and two analog inputs as well as two digital outputs and one analog output. The module's connection ports are spring-type terminals that accept cables up to 1.5 mm² in diameter. This type of terminal port generally allows for a quick and safe installation, and also permits faster servicing and maintenance during regular operation.

■ High rotation accuracy

The 8200 vector is particularly notable for its high rotation accuracy, which ensures excellent process repeatability. With current vector control, the nominal torque of the motor can be maintained from a frequency of 3 Hz up to the cut-off frequency (50 Hz for a four-pole motor). Over a period of 60 seconds, a breakaway or holding torque of up to 1.8 times the controller's nominal torque is available. For motors with 12 kW output power or more, 2.1 times the nominal torque is the maximum value. Lenze's new POWERLINK communication module serves to combine these drive features with the fieldbus system of the future.



www.Lenze.de

Pepperl+Fuchs: Absolute encoder with POWERLINK and TCP/IP interface: one encoder for all automation levels

A cost-effective networking alternative, Ethernet keeps gaining in importance throughout all network levels from the top to the field. Drive tasks in the field call for appropriate equipment, e.g. rotary encoders with adequate interfaces. These components must not only ensure simple connectivity to enterprise networks. Essential features also include real-time capability, intelligent extra functions and worldwide maintenance accessibility via standard browsers.

Ethernet – for standard and real-time applications

Wherever Ethernet encoders are needed in applications without special real-time requirements, devices with a TCP/IP interface are the ideal choice. They can easily be connected to and put into operation from any PC. However, they do not ensure deterministic transfer times: as the network load in-

creases, there are often collisions that need time to be resolved. While an appropriate network structure and switch installations will improve performance and may ideally result in cycle times of 1 ms, even shorter cycle times can be achieved by using devices with POWERLINK interfaces. POWERLINK totally avoids collisions by enforcing a cyclic timing schedule on top of the Ethernet protocol. The resulting cycle times are as low as 200 µs and suffice even for demanding drive solutions.

30 bit maximum total resolution

Pepperl+Fuchs Drehgeber GmbH supplies users with a range of different absolute encoders for connection

to Ethernet TCP/IP and POWERLINK networks. Customers can choose between solid shaft and recessed

hollow shaft models as well as single-turn and multi-turn versions.

The single-turn part achieves a 16 bit maximum resolution and may be complemented



by a multi-turn part which adds up to another 14 bits to that, thus yielding a maximum 30 bit total resolution. Like the fieldbus models, Ethernet encoders also provide additional device

functions such as a parameterizable position output, cam controller functions, current speed output and diagnostic capabilities.

Parameterization and operation from a PC

An HTTP web server was integrated into the encoders to allow for parameterization from a PC with a standard web browser. Based on HTML pages and Java applets, the user interface provides for comfortable configuration of parameters and convenient status message checks. Due to the consistent implementation of open communication standards, sensors of this type can, if the need arises, be operated and parameterized from any PC with an internet connection anywhere in the world.

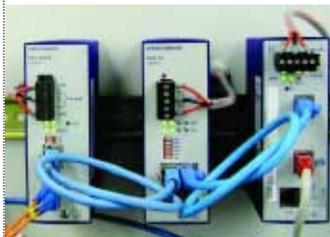
 www.pepperl-fuchs.com

Hirschmann Automation and Control GmbH: POWERLINK router – connection under control

A POWERLINK router provides controlled access to real-time segments of a network, which gives users transparent IP access from a remote station to the PLC, drives or I/O units. One major benefit of such devices is that tedious unit by unit network configuration is no longer necessary, since all components can be conveniently configured on the POWERLINK router. POWERLINK segments can simply be duplicated with no need for an adaptation of their internal configuration. Giving due consideration to security aspects, the specification also includes basic firewall functions.

Hard real-time capability with short cycle times and minimal jitter is usually only needed in a limited area, e.g. within a machine or part of a plant. Still, a system designer will want to integrate a real-time segment into a higher-level network, e.g. connect it to a central control room. However,

unless this connection is precisely defined, it can affect the performance of the real-time segment. Hence data traffic that is not time-critical, such as transfers of configuration, parameterization or diagnostic data, or web



access, is handled in a defined separate time slot. Access control for units within the real-time segment should also be implemented, i.e. only authorized devices should be granted access. In a POWERLINK installation,

all of the functions just discussed are provided by one specific component – the POWERLINK router.

Hirschmann's RR-EPL includes a static IP router to link the open Ethernet with the real-time network segment. It also supports the Network Address Translation (NAT) Protocol which converts internal POWERLINK addresses to external addresses as needed. Operating as a Controlled Node on the POWERLINK segment side, the router ensures a controlled injection of external data traffic into the asynchronous time slot. As a security measure, the product features an integrated firewall which manages access to POWERLINK devices based on MAC addresses, IP addresses, IP protocol type or UDP/TCP ports. The routers' configuration and diagnostic functions are available via SNMP, a serial port, a web interface or the POWERLINK protocol. The serial inter-



face can also be used to set up password-protected remote access to the segment. The router can be supplied within 10 days from order date.

 www.hirschmann.com

IXXAT: POWERLINK technology from a single source

IXXAT provides hard- and software components for the development of POWERLINK devices and supplies modules and interface cards for use in series applications:

POWERLINK protocol software

IXXAT's Ethernet protocol stack includes all features of the current POWERLINK specification and allows for the implementation of Managing Nodes and Controlled Nodes. The POWERLINK software is available in a generic version enabling easy porting to different target systems and platforms. It also leaves the choice of implementing POWERLINK in environments with or without an operating system.

Embedded module

IXXAT's POWERLINK module provides all POWERLINK functions for a Controlled Node, which makes this PCB a very flexible solution to POWERLINK-enable various devices such as drives, I/O modules or encoders. The core component of the embedded module is an Altera FPGA featuring a CPU (NIOS II), an Ethernet controller and a dual port hub. It communicates with the application CPU via a shared memory interface, i.e. a quasi dual ported memory.

PC cards for PCI and cPCI systems

IXXAT's POWERLINK PC cards can be operated as Managing Nodes as well as Controlled Nodes. They enable e.g. simple implementations of real-time capable PC-based PLC applications as well as analysis and test systems. User



data from a PC application (such as Windows with a real-time extension) are provided via a process image. A card can be connected to any operating system (including non real-time OS) via a POWERLINK API available on the PC.

POWERLINK safety

The safety software developed by IXXAT allows for implementing Safety Nodes, but also for handling the Safety Configuration Manager needed

for monitoring and updating the network configuration. TÜV has pre-certified the software.

Development services

In addition to the protocol software, IXXAT also offers training and consulting services as well as customer-specific development of hard- and software.

 www.ixxat.de

SYS TEC: POWERLINK starter kit

In light of increasing requirements in time-critical fieldbus applications, SYS TEC electronic GmbH is extending its product range by adding a POWERLINK protocol stack that complies with the current DS 1.0.0 specification. Years of experience with field bus systems informed the development of this new software component. Its modular software structure and ANSI-C implementation allow for easy portability to other target platforms, i.e. other microcontrollers and operating systems. Using the stack without an operating system is also possible. It supports Controlled Nodes as well as Managing Nodes.

SYS TEC electronic GmbH provides a preconfigured starter kit to facilitate user entry to the POWERLINK technology. The kit includes a development board with a Freescale Coldfire processor, an embedded Linux environ-



ment and a fully documented demo application.

SYS TEC electronic GmbH is one of the leading suppliers of embedded fieldbus solutions. The company's core competencies include time-critical CANopen applications and safety-related CAN and CANopen solutions. SYS TEC also provides services relating to the development of fieldbus devices and fieldbus systems. These include consulting, conceptual design, hard- and software development and series manufacturing in the company's own production facilities.

 www.systemec-electronic.com

port: EPL MAC/Hub-VHDL code

FPGAs provide device manufacturers with tailor-made, scalable and future-proof solutions. Major benefits of FPGA-based solutions include IP reusability, fast time-to-market for an implementation and good cost-efficiency. Optimized specifically for POWERLINK, port's EPL-MAC is a high-performance MAC controller for FPGAs. Its several prepared send buffers and its capability to respond automatically to POWERLINK packets are implemented directly in the hardware, which yields extremely short reaction times. Also available in VHDL for FPGAs and PLDs, the EPL-Hub is a generic hub which complies with the IEEE standard 802.3u, supports 100 Mbit half duplex connections, and enables simple network integration through daisy chain cabling. A single FPGA is

therefore sufficient for a solution featuring an Industrial Ethernet interface, hub logic as well as a processor core. In addition, the embedded processor can also be directly implemented in the FPGA. The XILINX Industrial Networking Kit "INK" can be supplied for evaluations of this VHDL solution.



 www.epl-tools.com

WAGO: Fieldbus coupler for POWERLINK

WAGO's IO SYSTEM 750 features robust, POWERLINK specification V2.0 compliant couplers for the industry proven POWERLINK fieldbus system. The coupler supports up to 64 I/O terminals, or even 250 via a bus extension. Its application interface is based on the CANopen communication profile DS 301 (i.e. EN 50325-4).

POWERLINK's key benefit is that it is both based on standard Ethernet and meets extreme demands on deterministic performance and cycle times. The protocol is therefore ideally suited for use in applications with hard real-time requirements, but also for reliably transferring large amounts of data within a given span of time. In addition, POWERLINK features a flexible, well-engineered application interface that gives users access to a broad base of existing device and application profiles.



Given its comprehensive range of I/O terminals, WAGO's IO SYSTEM 750 provides an industry-grade hardware base for POWERLINK.

WAGO POWERLINK in short:

- hardware base suited for industrial environments
- compact connection to POWERLINK V2.0
- extensive range of I/O terminals
- suited for applications with hard real-time requirements

 www.wago.com

Alstom Power Centrales: POWERLINK High Availability

Critical applications and costly loss of productivity

In many industry sectors, highly reliable networks are indispensable today, either because an application itself does not tolerate network failures (e.g. in the transport and energy industries), or because the productivity loss caused by a failing controller is unacceptable. In order to provide a real-time solution that meets such requirements, the EPSG's High Availability Working Group will publish the POWERLINK High Availability Specification by the end of this year. The new specification is an add-on to POWERLINK V2 and is fully compatible with all POWERLINK V2.0 devices.

Multiple redundancies

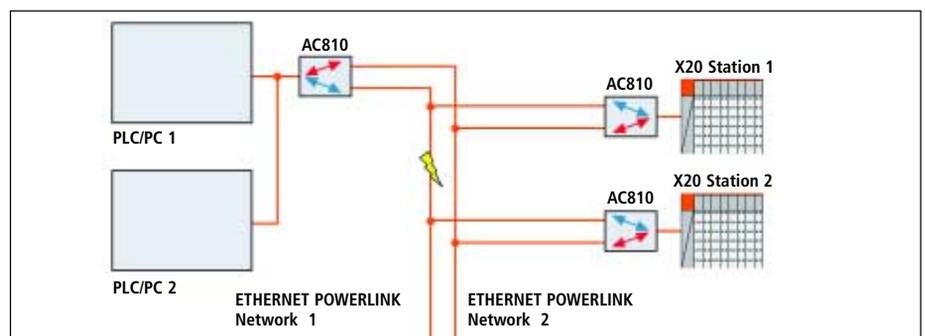
With POWERLINK High Availability, system availability is guaranteed in case of a component failure. Both

the nodes and the medium itself are redundant to avert a Single Point of Failure in the system, i.e. a full system breakdown due to a single hardware or software component going out of order. Managing Node redundancy ensures that the POWERLINK cycle is continued, which keeps up synchronicity and maintains low jitter in case of a node dropping out. Controlled Node redundancy enables several

senders/receivers to handle the same data. Using two transport media for the same data at the same time prevents complete system failures if a network component such as a cable or hub malfunctions.

Guaranteed availability

POWERLINK High Availability yields a system recovery time in the region of



the POWERLINK cycle time, ensuring a quick return to normal operation without any downtime of the system as a whole. B&R's Link Selector AC 810 allows for connecting all standard POWERLINK devices (CN) to the redundant network.

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POWERLINK TOP TEN

FACT 1: THE ORIGINAL

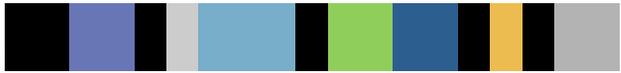
POWERLINK – the first real-time solution for Industrial Ethernet



1

Introduced as early as 2001, Ethernet POWERLINK was the first fully functional hard real-time Industrial Ethernet solution. Its launch marked the beginning of an international success story – today, POWERLINK is used by more than 200 machine builders around the world. www.ethernet-powerlink.org

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