ETHERNET POWERLINK

Powerlink FACTS

Volume 1, Issue 2/November 2006

One For All

Pepperl+Fuchs
Encoder for all Levels

Universal Connection

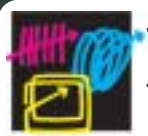
Deutschmann:
One Router – Two Ethernet Ports

Technology From a Single Source

IXXAT Provides
Hard- and Software

Interview with Dr. Edwin Kiel

Frequency Inverters
Dig ETHERNET
Powerlink



Welcome to the EPSG Stand at the Fair Hall 6/Stand 222

Nuremberg 28 – 30 Nov. 2006

ETHERNET POWERLINK STANDARDIZATION GROUP

Three Questions: EPL and Drive Manufacturers

Dr. Edwin Kiel, Head of Innovation at Lenze, says: "Frequency inverters dig ETHERNET Powerlink." PowerlinkFACTS's Editor in Chief Rüdiger Eikmeier asked for details.

R. Eikmeier: Dr. Kiel, why are several manufacturers of frequency inverters now opting for Powerlink?

E. Kiel: First of all, for manufacturers of frequency inverters, Powerlink is just another fieldbus to support. As customers are requesting this interface, component makers must provide it. It's a fact that Powerlink is used by an increasing number of machine engineers and constructors. And their systems not only rely on servo axes for dynamic tasks, but always on a range of frequency inverters, too, for all kinds of uses from transporting materials to driving tools and fans. So, understandably, customers would like to see unified project planning for all drives.

R. Eikmeier: But which technological benefits does Powerlink hold for drives?

E. Kiel: Powerlink provides equal support for centralized or decentralized, i.e. controller-based and drive-based solutions. There is a mature set of features covering all necessary capabilities for that, e.g. cross-traffic etc. Hence, with Powerlink, we can create powerful toolkits that enable users to implement and service even demanding applications easily. Also, since more and more end customers lack trained personnel for service and maintenance work, these duties are delegated to machine manufacturers as well, who therefore depend on simple remote maintenance and diagnostics. That, too, is one of Powerlink's strong points. For us at Lenze in particular, EPL is a good fit for our new drive and automation architecture L-force, which was designed to deliver innovative comprehensive solutions. These, of course, can only be as innovative as the components they are based on. That calls for an Ethernet solution in the drive that not only combines a state-of-the-art IT standard with real-time capability for motion control applications, but also e.g. includes drive-based safety, i.e. directly integrates safety technology into the drive controller. For many of our developments, safety is a make-or-break issue. In this area, Powerlink clearly has an edge over its competitors, since it provides a fully-fledged, certified standard we can immediately put to use.

R. Eikmeier: And what about sheer perfomance? Doesn't e.g. EtherCAT deliver more speed especially in drive applications?

E. Kiel: I suggest we simply do a few calculations. The performance of different Ethernet solutions has been widely discussed for quite some time, but Gigabit Ethernet networks will end the debate for good, since you cannot even take full advantage of gigabit speed in real-world drive applications. Servo drives, for example, are known to be clocked at 16 KHz. Increasing the frequency beyond that would be nonsense – there's a physical limit imposed by magnetism. In plain language: you can't get the current into the motor any faster. This results in current control cycles of typically 32 µsec. You need maybe 64 bits to accommodate the rotor position value, possibly some other status data and the magnitude of the electric current. The necessary data throughput for your bus solution can easily be calculated. If one central master is responsible for e.g. current control in 100 servos, that's 64 bits times 100 drives every 32 µsec. That equals 200 Megabits per second – which means an application of this kind will only utilize 20% of the gigabit bus bandwidth, or maybe 40% with an enormous amount of overhead factored in. That's why I'm convinced there is no longer anything to argue over in terms of the performance of Ethernet fieldbuses. Any solution based on standard hardware and a gigabit-capable software protocol will generally be fast enough. Then again, if you are using Ethernet ASICs, you have to start from the beginning and develop new chips suitable for gigabit speed to keep up. One might question whether that is an economically viable alternative.

port: Protocol Software for EPL Device Development

An accurate and quick implementation is any developer's prime directive – a goal, however, that is hard to accomplish on one's own. Instead, it is advisable to rely on tried and tested tools and experience: port has therefore created a comprehensive chain of tools for EPL device development around the EPL protocol library at its core. It is based on decades of experience with CANopen.
The software package is supplied in source code. Major portions of the code are hardware independent to enable its use on different platforms. Hardware access functions for the Ethernet Media Access Controller are encapsulated in a separate module. The library features comprehensive databases for the implementation of key device profiles, such as the CiA 402 drive profile or 401 standard I/O routines. As these are already used in a range of CANopen projects, this is a proven technology which can quickly be applied in EPL environments as well. Device developers can rely on the flawless interoperation of the protocol stack and object directory, and can focus full-time on the integration of the application at hand.

www.epl-tools.com

2/2006

Powerlink FACTS

Cover illustration

Frequency inverters from Danfoss, KEB, Lenze and Schneider

Interview

Hardware

Software

Hard- and Software

Software or Hardware?

Today, even hardware consists largely of software – i.e. it is made up of microcode in the controllers and FPGAs at the lowest level, of device profile implementations at higher levels, and, in the future, of entire system descriptions in XML. There's a reason for that: software allows for the most flexible solutions. That is exactly why ETHERNET Powerlink is a software based real-time communication technology. And, as is widely known, EPL integrates CANopen device profiles into its own architecture. Building on the profiles of the most widely used fieldbus, the new standard provides high quality and reliability – and CANopen-related software investments pay off for EPL as well. Several manufacturers provide development, test and diagnostics systems for EPL implementations. It is the power of these tools which did most to win over heavyweights in machine and plant engineering – e.g. Heidelberger Druckmaschinen AG, which just joined the EPSG. The question EPSG members are asked most frequently may be the one about the time it takes to get an EPL version of a product to the market. Our answer is considered one of the strongest arguments in favor of the standard: migrating CANopen applications to Powerlink requires only man-days for I/O components. Adaptations of complex applications – e.g. involving Motion Control – are completed in a few man-weeks. But even if you are still convinced that a hardware solution is better for you, a true surprise is waiting for you at the SPS/IPC/DRIVES fair. Some software manufacturers will showcase their hardware kits for ETHERNET Powerlink there. Why, then, hardware, after all? Because it's hardware featuring the flexibility of software mentioned above. The FPGA solutions presented in Nuremberg enable Powerlink applications to be integrated into a chip, but still allow for the full scope of customization to your needs. You remain independent and benefit from the openness. Like ETHERNET Powerlink and the EPSG.

Dipl.-Ing. Heinz-Jürgen Oertel
General Manager, port GmbH

Enjoy PowerlinkFACTS –
and we'll see you at SPS/IPC/DRIVES!
Dipl.-Ing. Heinz-Jürgen Oertel

WAGO: Fieldbus Coupler for ETHERNET Powerlink

WAGO's IO SYSTEM 750 features robust, EPL specification V2.0 compliant couplers for the industry proven ETHERNET 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).

The major benefit of ETHERNET Powerlink 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, EPL features a flexible, well-engineered application interface that gives users access to a broad base of existing device and application profiles.

The WAGO I/O SYSTEM 750 provides a comprehensive range of I/O terminals to give ETHERNET Powerlink a hardware base suitable for industrial environments.

www.wago.com

The new ETHERNET Powerlink coupler from WAGO

WAGO POWERLINK in short

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

B&R: Frequency Inverters of Leading Manufacturers Integrated into Automation Studio

B&R Automation Studio, the only software tool for integrated automation solutions, now supports seamless integration of frequency inverters from

Leading frequency inverter manufacturers have opted for ETHERNET Powerlink

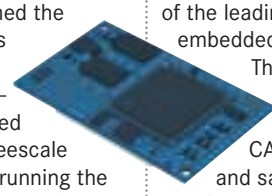
leading manufacturers Danfoss, KEB, Lenze and Schneider. This is made possible through the use of ETHERNET Powerlink, the only open industrial Ethernet network system that is in widespread use in series applications. It enables simple integration of the inverters into the system and ensures their operability in a real-time network with servo amplifiers and I/Os. Users only have to select a designated device and assign variables to it in a dialog box. The inverters are also parameterised in Automation Studio.

Since its introduction in 1996, B&R's Automation Studio has provided an integrated development environment for control tasks, visualisation, drive units and communications that stays with users from the initial programming to commissioning and start-up and on to the production and service phases. Thanks to its scalability, platform independence and flexibility the software meets all requirements for one single project planning and programming tool to cover all types of application tasks and system platforms – from the most basic machines to complex processes.

www.br-automation.com

SYS TEC : EPL Protocol Stack and Services

In light of increasing requirements in time-critical fieldbus applications, SYS TEC electronic GmbH is extending its product range by adding an EPL 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. It was commissioned and tested extensively on a Freescale Coldfire processor running the open source Linux operating system. 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. The stack was developed in parallel to infoteam Software GmbH's PowerMAP configuration software. Both software components are fine-tuned for interoperation with each other.



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 systems. These include consulting, conceptual design, hard- and software development and series manufacturing in the company's own production facilities.

www.systec-electronic.com

Baldor:

3-phase AC motor drives

New system building flexibility for large machines

Baldor is launching a ground-breaking family of three-phase AC motor drives. In addition to introducing the flexibility of ETHERNET Powerlink and TCP/IP connectivity into the high-power machine building sector, a focus on modularity, plus novel design features, provide significant potential for saving costs and performance gains.

A new family of ETHERNET Powerlink compatible three-phase AC drives – MotiFlex e100 – can be used in both centralized control and distributed 'intelligent drive' scenarios, in both cases with substantial savings in the electrical power components typically required. The initial launch provides drives rated for output powers up to 16 A, in five steps. Higher power versions will follow.

Compatibility with the ETHERNET Powerlink protocol introduces great flexibility into electrical system building. Each drive features an Ethernet hub enabling systems to be built using a simple daisy-chain connection scheme. The high-speed and deterministic ETHERNET Powerlink network, operating at 100 Mbits/sec, cuts cabling substantially, and can greatly reduce the costs of building large multi-axis systems. For example, a single Baldor ETHERNET Powerlink machine controller can manage systems up to 16 interpolated axes, and many more non-interpolated axes.

System cost savings

In terms of core performance as an AC drive, a Baldor development team has been working for over three years on MotiFlex. The resulting design incorporates a large range of features that serve to liberate high power machinery builders to make savings and improve machine performance.

Each MotiFlex drive can operate independently, or as part of a shared DC bus system. When operating in a shared DC bus system, power regenerated back into any drive during the deceleration phase of an axis may be utilised by the other axes, saving energy costs. As each drive has a local capacitor bank, an external braking resistor is often not required - because the total capacitance of the system may be sufficient to store the energy without reaching the over-voltage limit.

Shared DC bus

Unlike traditional shared DC bus systems, MotiFlex drive systems do not require a separate power supply unit. Instead, the AC–DC converter stage in each drive is capable of supplying power not only to itself, but also to a drive or combination of drives of the same total rating. For many multi-axis applications, this will often mean that the highest-rated drive will be able to power the rest of the system.

For many multi-axis systems, this approach almost invariably results in the need for fewer electrical components, and simpler system building, as only one set of contactors, fuses or MCBs, terminal blocks, and one EMC filter is needed for the whole system. Alternative approaches on the market today can require the same AC components for each drive, or the addition of separate power supplies and capacitor banks with fixed ratings that often mean they may be oversized for the application in question.

The drive's control electronics can draw power from the main AC-DC power supply, or from a 24 VDC linking system on the front panel. Using the 24 VDC supply ensures that the control and communications status are maintained if the system is used in an application subject to safety shut downs, where the mains supply is disconnected.

Option card slots

Configuration flexibility has been at the core of the design requirements. Each drive incorporates a universal encoder input (incremental encoder, EnDat, SSI, sincos, multi-turn and single-turn) and built-in I/O (three digital inputs, two digital outputs, a ±10V analog input, brake control output, plus CANopen and USB ports). A further two 'option card' slots provide an expansion capability that allows users to precisely configure the local attributes of the drive, and/or provide an upgrade path. The choice of expansion options includes analog and digital I/O, resolver feedback, encoder feedback, and fieldbus interfaces including Profibus, Modbus, Devicenet and emerging Ethernet versions.

A further unique expansion option for the drive is a plug-in machine controller compatible with Baldor's Mint motion language. This option allows a MotiFlex e100 to be used as a standalone 'intelligent drive', providing a distributed motion solution that can cut hardware costs dramatically. This Mint card is also ETHERNET Powerlink compatible, and will control further daisy-chained MotiFlex e100 drives. If more axes are required, Baldor's panel-mounting NextMove e100 controller provides a solution.

The new drives complements Baldor's existing range of ETHERNET Powerlink products for motion control, in addition to Baldor ranges of servo motors and linear motors. Developers can now choose from single-phase and three-phase drives, a panel-mounting machine controller suitable for large multi-axis systems and machinery, and a lower-cost plug-in board solution for 'intelligent drive' and simpler applications.

www.baldormotion.com/mf1

Hirschmann:

ETHERNET Powerlink Router – The Link between EPL and Factory Network

An EPL router provides controlled access to real-time segments of a network, which gives users transparent IP network access from a remote station to the PLC, drives or I/O units. A common network configuration for all components can be set up on the router. Giving due consideration to security aspects, its specification includes additional firewall functions.

Integration and separation

Hard real-time capability with short cycle times and minimal jitter is usually only needed in a limited area, i.e. 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, so users may benefit from consistent access to all devices. Parameterization, configuration and diagnostics can then be performed at runtime from a central or even remote point of access. However, unless this connection is precisely defined, it can affect the performance of the real-time segment. ETHERNET Powerlink features a timeslot procedure to ensure strictly deterministic performance. Asynchronous data traffic, such as transfers of diagnostic or configuration data, web communication etc., is handled in a separate time segment.

Another aspect of segmentation is access control. In a larger network, safeguards must prevent just any device from accessing – whether on purpose or inadvertently – components of the real-time segment with their critical functions. The EPL specification meets this requirement by defining certain mechanisms that check for access rights to such a segment.

The router

In an ETHERNET Powerlink installation, all of the functions just discussed are provided by an EPL router. Just like routers in the office world, it links two networks at the IP level. This component is usually an autonomous device with at least two network access ports: One interface connects it to the standard Ethernet network, the other one to the EPL network.

On the EPL side, the router must meet the specification for a Controlled Node and must respect timing requirements in the Powerlink segment. Hence, IP traffic is transferred exclusively in the asynchronous part of a cycle, and is limited to one IP packet per cycle. The maximum packet length is determined by the configuration of the Powerlink cycle; if necessary, packets that exceed it are fragmented by the router.

In every other respect, EPL routers also provide typical functions of conventional routers. They operate with static routing, i.e. fixed configurations of routing tables. Network Address Translation, or NAT for short, ensures transparent communications between a node within an EPL segment and devices on the external network.

Access control

Being the interface to the real-time segment, the EPL router is also the best place to implement security mechanisms to protect the network. Among other features, these include a firewall with configurable packet filter functions. Lists indicate which packets are accepted, and if and to which devices they may be routed. The EPL specification defines MAC and IP addresses, IP protocol types and UDP/TCP ports as viable parameters.

Further functions

Besides data routing, management is another major function of EPL routers, allowing for configuration and diagnostics via SMNP as well as the EPL protocol.

Hirschmann's RR-EPL

A compact device for mounting on a top-hat rail, Hirschmann's RR-EPL Powerlink router meets all requirements for transparent and secure access to an EPL real-time segment. It is equipped with either a twisted pair or fiber-optic port for connection to the open Ethernet network. A twisted pair interface links it to the EPL segment, where it operates as a Controlled Node. Besides its IP routing function, NAT and a firewall that boasts both high performance and easy configurability, the RR-EPL also provides password controlled access via a serial port, which enables e.g. remote diagnostics for the entire Powerlink segment. The router can be supplied within 10 days from order date.

www.hirschmann.de

SHF: Complete Set of EPL Key Components

SHF's Ethercontrol product family consists of a PCI Manager, an EPL gateway and a variety of I/O modules. The EPL gateway makes monitoring the EPL network and accessing the module parameters extremely easy. The PCI Manager (MN) is equipped with a dual port RAM interface; drivers and sample software are supplied in source code, which simplifies its use with any operating system. Thanks to its dual port hub and an optional gateway port, the PCI Manager is suited for small-scale as well as more extensive EPL networks. Its auto crossover function enables very comfortable cabling. When operating as a

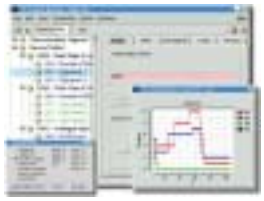
Controlled Node (CN), it ensures simple data transfer between the PC and control system. Featuring different combinations of inputs and outputs, Ethercontrol I/O modules ideally complement any drive controller. An integrated web server allows for convenient control over and simulation of I/O functions.

www.shf.de

port: ETHERNET Powerlink Toolchain

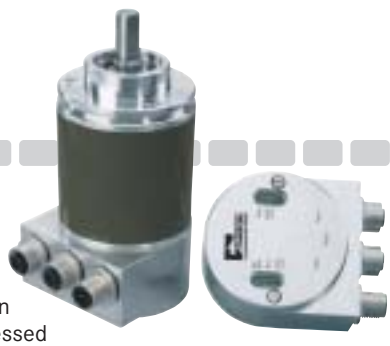
Powerful tools are needed for quick development of EPL devices and a successful operation of EPL networks. One of these is port's EPL-Report, a graphic network analyzer which records, processes and evaluates telegrams. Its functions include faulty frame recognition and statistical data analysis,

enabling its targeted application in V1 as well V2 networks. EPL-Report automatically differentiates between V1 and V2 networks. port's ETHERNET Powerlink Device Monitor (EDM) simplifies device development and provides functions for the configuration, start-up and integration of devices and networks. Its integrated scripting language makes automating functions very simple and allows for easy adaptation of the interface to various applications such as development tests and production tests. Plug-ins with special functions for different device profiles are additionally available.



www.epl-tools.com

Pepperl+Fuchs: Absolute Encoder with Powerlink and TCP/IP Interface – One Encoder for all Automation Levels



A cost-efficient 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 increases, 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. ETHERNET 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

infoteam: PowerMAP for CANopen and ETHERNET Powerlink

Readily available, powerful software tools from independent developers are more and more crucial to the spread and eventual success of fieldbus systems on the market.

Universal solution
infoteam's PowerMap is a software tool for manufacturer-independent, efficient parameterization and start-up of hardware. It supports ETHERNET Powerlink as well as CANopen. Components can be configured with PowerMap using either standardized device description files or the devices themselves. PowerMap accepts both current ASCII formats (EDS, DCF) and XML files (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.

Template-based configuration
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
- Fieldbus configuration for distributed EPL-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 ETHERNET Powerlink are optionally available; However, PowerMAP does not work exclusively with protocol stacks from hardware manufacturers, but also with all other implementations that adhere to the standard. The software's function blocks for ETHERNET 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).

Interoperation with IEC 61131-3
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

FRABA POSITAL: EPL Absolute Encoders with Automatic Protocol Switching

FRABA's EPL absolute encoders are perfectly suited for operation in ETHERNET Powerlink networks and can be very easily integrated into a given application. These models are part of the tried and tested OPTOCODE series. Their integrated ETHERNET Powerlink interface automatically adjusts for the protocol in use. Both the older version and the current open variant of the protocol are supported. While the cost-effective line structure preferred for many networks can be maintained when using these devices, alternative wiring topologies are also an option thanks to an integrated dual port hub. 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. Signal LEDs convey the network status (Link, Collision, Receive) and serve to display the Powerlink device status. Configuration is very simple: a network address is assigned to an encoder by setting its device IP address using two turn switches on its interface unit. Device replacements do not require any configuration effort since the actual encoder can easily be detached from the interface unit.

www.posital.de

B&R: ETHERNET Powerlink Revolutionizes Real-Time Ethernet

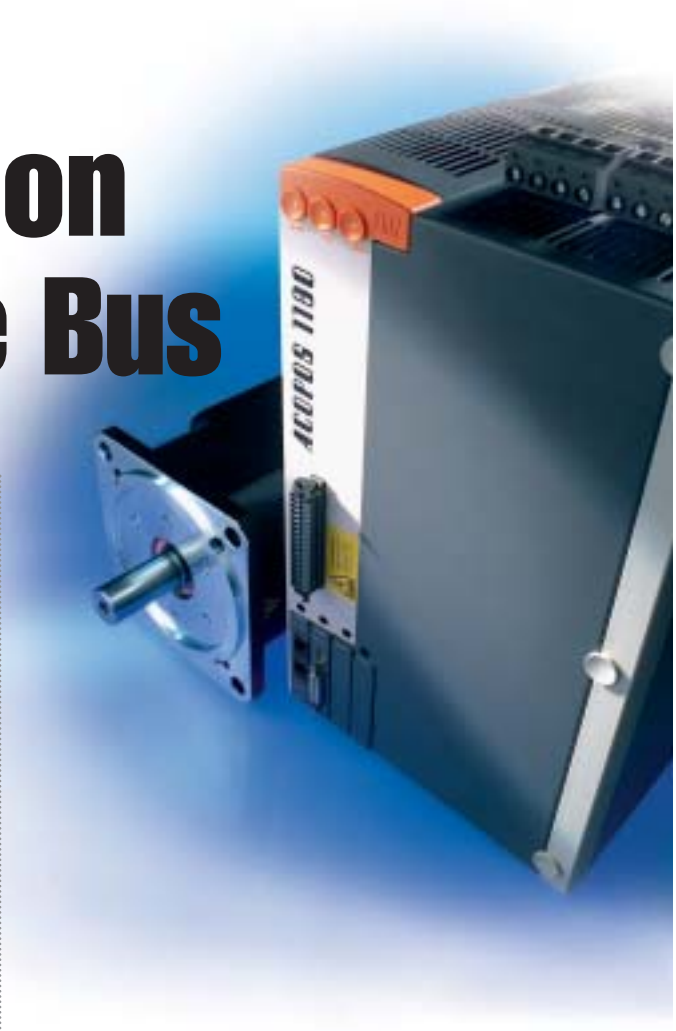
As Gigabit Ethernet is being implemented, the next leap in performance in the field of network technology is pending. Faster by a factor of 10 compared to its predecessor, Fast Ethernet, this new technology yields direct benefits for ETHERNET Powerlink, making it several times faster than all other real-time Ethernet variants currently on the market or due to appear.

The adaptation is simple, since ETHERNET Powerlink was designed as a software based, completely open system in order to accommodate such enhancements. The migration from Fast Ethernet to Gigabit Ethernet only requires a replacement of the hardware platform, while the EPL standard itself remains totally untouched. ETHERNET Powerlink thus provides a solid platform even for future high performance applications, making EPL technology a low-risk investment in the long term.

Safety-oriented solutions also benefit from the competitive edge in ETHERNET Powerlink Safety's performance: a higher data throughput was already taken into consideration for the fundamental development of that safety protocol.

www.br-automation.com

B&R: ACOPOS – Servo Drives on the Real-Time Bus



Due to a flexible system design, B&R's ACOPOS series of bus-enabled servo drives for machine engineering can be precisely adjusted to the requirements of a given application. Four groups of drives cover a performance range from 400 W to 64 kW. ACOPOS servo amplifiers support the operation of all common motor types such as synchronous motors, asynchronous motors with or without a feedback system, linear motors or direct drives, and achieve current control sampling times as low as 50 µs.

Real-time option

Depending on the model, they provide up to two plug-in slots for technology modules, bus connections, encoders or I/Os, including CAN and ETHERNET Powerlink interfaces. Up to 240 axes can be operated on one EPL network line. Transfer speeds up to 400 µs are accomplished with multiplex control of the axes. B&R's development environment Automation Studio, an integrated tool for software creation as well as diagnostics and start-up functions, supports checks of motor and boundary layer temperatures, samples of electric current data, contouring error data, and of numerous other diagnostic values in real-time via the ETHERNET Powerlink bus. Of course, all of these can also be used for machine visualization.

Integrated safety technology

ACOPOS servo amplifiers are equipped with TÜV approved safety technology that prevents unexpected motor starts and ensures safe stops from regular operation and safe emergency stops. The integrated restart inhibit function complies with safety category 3 according to EN 954-1. The requirements laid down in EN 1037 (prevention of unexpected start-up) and EN 60204-1 (concerning category 0 and 1 stop functions) can also be met. A minimal external wiring effort thus achieves a maximum of safety. Saving both space and costs, the energy separation of the drive no longer depends on mains contactors and relays in the motor lines and on a discharge of the link capacitors.

www.br-automation.com

Weidmüller: Secure Contact – IE-line Ethernet Connector Range

Weidmüller's new IE-Line range of Ethernet connectors features crucial benefits: they allow for toolless 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.

STEADY*TEC* 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.

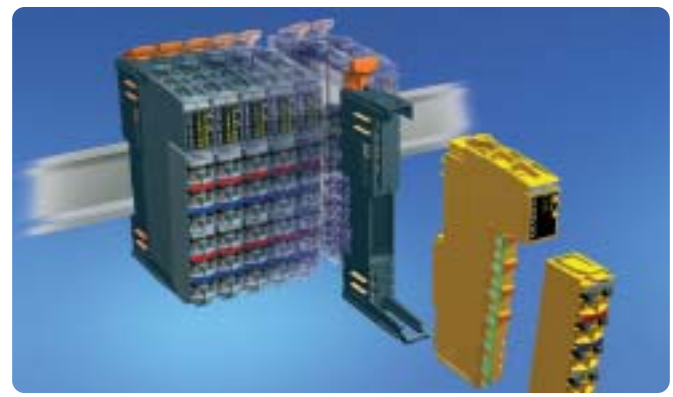
STEADY*TEC*
Clever, flexible, modular – the Ethernet connector system by Weidmüller

www.weidmueller.de

B&R: Integrated Safety with EPLsafety

B&R supports EPLsafety, the first safety bus based on a real-time Ethernet implementation. Extremely low cycle times of 200 µs for SIL 3 and reaction times that have been reduced by a factor of 10 herald a new era in safe communication. The open standard thus combines the benefits of hard-wired solutions with those of the latest integrated and intelligent safety equipment. A decentralized distribution of I/Os provides more flexibility and cuts costs for standard as well as safe I/Os. Migration to this new technology is exceptionally simple, since it requires no more than adding I/O nodes to the safety modules.

www.br-automation.com



Deutschmann: EPL Router Links Real-Time and Standard Networks

One key argument in favor of Industrial Ethernet is that it makes consistent communication possible. Deutschmann's ETHERNET Powerlink router puts this idea into practice:

Linking real-time and standard IP networks, this device enables any intranet PC to access EPL nodes on the Powerlink network via TCP/IP without compromising the real-time cycle. The router has two Ethernet ports to fulfill this function. One is connected to the ETHERNET Powerlink network, the other one provides the IP network interface.

Each port has two LEDs which signal the live Ethernet connection (Link) or network activity (LAN), respectively. The port on the EPL side has additional status (BS) and error (BE) LEDs.

The gateway supports the EPL protocol stack version 2.0 and can be deployed as a CN-based gateway or optionally as an MN-based gateway/router.

An address switch (ID) serves to set the EPL network node ID of the device. It also allows for selecting the Powerlink mode: with the node ID set to 240, the device operates as a Managing Node, while every other ID triggers Controlled Node operation.

Special-purpose software interfaces for PC-based configuration tools are optionally available, including the EPL Device Monitor and an interface for the EPL-Report analysis tool.

An integrated HTML form allows for NAT routing configuration from any web browser. The router is available as a C profile rail module measuring 23 x 100 x 155 (W x H x D). It is suited for 24 V DC power supply.

www.deutschmann.de

Lenze: From CAN to ETHERNET Powerlink:

The Next Step in Industrial Communication

Modular and scalable design: controllers from the L-force Servo Drives 9400 range

State-of-the-art drive and automation technology is unthinkable without industrial communication systems. For any automation architecture and any type of application, there is currently a trend towards using only one communication system whenever feasible – CAN, for example, is used exclusively in many cases. Like CAN, ETHERNET Powerlink also supports different architectures, i.e., in this respect, EPL introduces CAN features to the Ethernet world. However, in contrast to simple master-slave communication structures, EPL users benefit from greater degrees of freedom in setting up distributed automation functions.

Any machine automation solution with controlled drives generally operates at three levels: Logic Control, Motion Control and Drive Control. While drive control is carried out within the inverters, since that is where all data from and to a drive converges, the implementation of the other two control tasks depends on the purpose of a drive and the type of motion involved, and allows for either decentral, i.e. drive-based, or centralized, PC and controller-based setups.

As long as axes move independently, there is no close timing connection between individual motions. This is often the case e.g. in applications involving materials handling or in the traction and hoist drives of rack feeders. Motion guidance is performed within a drive, sequential commands originate from the logic controller. Potential jitter that usually arises from communications between the PLC and I/Os does not amount to a problem in these kinds of applications. That said, all field bus systems, i.e. including those with soft real-time capabilities, are suitable for such cases.

Electronic motion synchronization, which often replaces shaft-coupled mechanical solutions, must ensure precise coordination between a master drive motion and related movements of the slave drives. The lead motion is generated by one drive whose position has to be communicated to the distributed slaves, whose own movements must be decentrally executed according to e.g. cam disc or electrical shaft functions. Such setups are typically found in continuous or cyclic production processes. Both CAN and ETHERNET Powerlink provide the cross-communication capability needed here.

Whenever several drives simultaneously generate a multi-dimensional movement with very high path accuracy, e.g. in machine tools and robots, the motion profile is usually calculated by a central controller which then provides all individual drives in the field with the contingent position sequences. Master-slave communication with synchronized timing is sufficient in such cases. However, for large machines and installations, several motion controllers may well have to be deployed at once, in which case they must also be synchronized with each other. This is another case that relies on working cross-communication. Notably, though, such architectures also require that the tasks of the communication manager be decoupled from the machine control of a modular machine part. CAN and ETHERNET Powerlink meet both of these requirements. Thus, both allow for implementing modular machine automation structures.

Functional segmentation of a drive system

However, due to ETHERNET Powerlink's significantly higher data throughput and greater cable lengths allowed, the new protocol surpasses CAN in terms of the potential extension and performance level of automation networks. Also, its asynchronous communication channel provides a means to reach all connected devices with TCP/IP packets and ensure consistent communication throughout the network.

Lenze's drive and automation technology is tailored to all requirements and architectures described above. The new Servo Drive 9400 Stateline, for example, supports DS-402 drive profiles and stays in touch with a central controller via its ETHERNET Powerlink module. Lenze's product line-up also includes e.g. the Highline controller, whose ETHERNET Powerlink module also assumes the tasks of the manager and ensures working cross-communication.

Summary

ETHERNET Powerlink features hard real-time capability, consistent cabling and consistent network communications from the enterprise level to the drives in the field. It does away with the performance limits of established bus systems and provides a foundation for new automation concepts in machine and plant engineering and construction. Lenze's product range of L-force Servo Drives 9400 delivers suitable solutions. Shared features between EPL and the CAN system simplify adapting systems to the Ethernet age.

www.Lenze.de

Hilscher:
netX – A System-on-Chip Solution for ETHERNET Powerlink

Users who want to exploit ETHERNET Powerlink's true bandwidth potential will, depending on the application, face limits sooner rather than later if they rely on conventional hardware platforms. The cause lies in the combination of a Standard Ethernet MAC and application controller typically found in such components. Hilscher has therefore developed its System-on-Chip solution netX, which fully unleashes the benefits of ETHERNET Powerlink, and, in addition, provides users with extra computing power for their own applications.

The netX has two Ethernet channels which come with the analog component, the so-called PHYs, already integrated. An optimized Medium Access Controller (xMAC) is connected to the PHY via MII. The xMAC serves to control the sending and receiving of Ethernet packages, verify their checksums and detect collisions on the network. A repeating hub is integrated between the two channels, enabling hook-up of an additional EPL node with no need for a separate external hub device.

The xMAC is subordinate to a purpose-developed Protocol Execution Controller (xPEC), which analyzes the Ethernet header and passes only those Ethernet frames relevant to the node on to the EPL protocol stack within the application layer. The xPEC also fully integrates the EPL Data Link Layer functionality, and thus does away with conventional interrupt latency times between the Ethernet MAC and application controller. This implementation ensures that a Controlled Node can respond to a Poll Request from the Managing Node with a Poll Response immediately after the Inter Package Gap is concluded, which puts the available Ethernet bandwidth to full use. Data is transferred via 32-bit DMA between the xPEC and the application controller, i.e. it causes no load on the ARM CPU.

Higher-level CANopen protocol layers are handled on the ARM 926. The CPU's 200 MIPS provide enough processing power to keep small applications running on the netX besides the EPL protocol stack.

Features:
ETHERNET Powerlink V2.0, based on netX technology

- Managing Node (MN) and Controlled Node (CN)
- 2 PHYs/MACs integrated
- Integrated class II repeater enables implementation of daisy chain topologies to minimize the need for stand-alone hubs
- Response time for Poll Requests ≤ 1 µs (Inter Frame Gap)
- Integrated high performance application controller

www.hilscher.com

Hyperstone: Efficiency Embedded
The Art of Real-Time

Founded in 1990, Hyperstone AG is a fabless semiconductor company based in Konstanz that develops and markets microprocessors and microcontrollers. It has been part of CML Microsystems PLC since 2003.

Hyperstone's hyNet "Network Communication Controller" product family is an in-house development based on a dedicated RISC/DSP architecture. This application-specific System-on-Chip solution targets a range of markets such as industry automation, energy and building management, safety technology, telecommunications and home automation.

The hyNet "Network Communication Controller" supports a host of different interfaces including e.g. Ethernet, CAN, PCI, USB 2.0, ATM and most serial protocols. Featuring an integrated hub and IEEE1588 support, the Ethernet subsystem has been specifically tailored to real-time Ethernet applications in e.g. ProfiNet, Ethernet/IP and, of course, ETHERNET Powerlink networks.

www.hyperstone.com

Smart Network Devices:
EPL Protocol Stack from Smart Network Devices

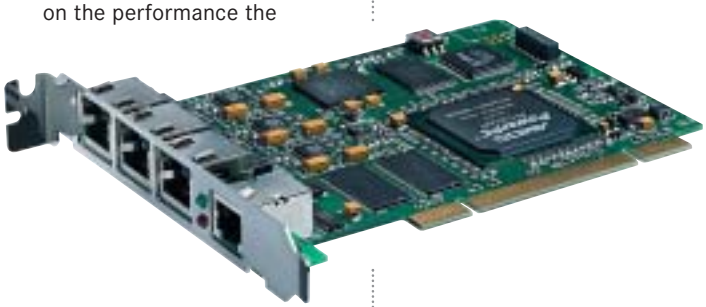
Jülich-based real-time Ethernet specialist Smart Network Devices (SND) is one of the leading suppliers of ETHERNET Powerlink (EPL) solutions for EPL field devices and controllers of any kind. Integrated into the company's native HyNetOS® operating system, SND's EPL stack – which is available as a Managing Node (MN) as well as a Controlled Node (CN) implementation – provides a variety of extensions that far surpass the original EPL protocol. It boasts its own TCP/IP stack, HTTP and FTP servers and file system, making configuration and status monitoring web pages in the device itself accessible from any web browser; a transfer of one single file via FTP suffices for simple firmware updates; alerts and status messages can be dispatched by e-mail or SMS – and all of that is, of course, possible at runtime in a real-time environment. In addition, there are versatile tracing features to be used from a PC to gain insights into the inner workings of the device firmware. The tracing function uses either the UDP protocol in parallel to EPL communications or a high speed debug probe that was specially engineered by SND. The latter achieves a data throughput of up to 20 Bit/sec, enabling it to keep an event log even in fast cycles of e.g. 500 µs.

EPL development kit available from Smart Network Devices

www.smartnd.com

Janz Automationssysteme: PCI Slot Card With ETHERNET Powerlink Interface

Janz Automationssysteme's EPL PCI interface is the ideal solution for integrating host systems into ETHERNET Powerlink automation environments. Plugged into a free 32-bit PCI slot, the interface enables communication with either one or two EPL networks, depending on the performance the application calls for. The ETHERNET Powerlink communication profile is fully processed by the integrated CPU on the PCB. The Windows 2000/XP (embedded) and Linux operating systems are supported; support for other operating systems (VxWorks, QNX etc.) is available on request. The EPL 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.



www.janz.de

B&R: ETHERNET Powerlink-based X20 Bus Controller

The EPL bus controller gives the X20 system real-time Ethernet connectivity

The X20, a bus controller for ETHERNET Powerlink (EPL) networks, is the latest step in B&R's completely modular strategy in the I/O slice product segment. The X20 is only 37.5 mm wide, which makes it the most compact bus controller available on the market. Made up of a base module, an energy supply module to supply the voltage for the entire system, and the fieldbus interface itself, this bus controller allows for a very flexible fieldbus connection. The entire bus-independent backplane can be preinstalled. Pre-wiring is also possible thanks to the unit's removable terminals. The X20's two RJ45 interfaces enable economical daisy chain wiring. To transfer or receive data from or to I/Os on the fieldbus, the bus controller does not need to be programmed – these functions are simply parameterized at the fieldbus master.

ETHERNET Powerlink provides cycle times of 200 µs. Thanks to its real-time capability, the EPL bus controller is fully synchronised to the network and all axes connected to it. Cross-communication, e.g. for acquiring rotary encoder values to directly forward position data to the axes, is also possible. This functionality does neither create additional load on the CPU nor cause delays resulting from several transfer cycles.

www.br-automation.com

IXXAT: EPL Technology from a Single Source

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

ETHERNET Powerlink protocol software

IXXAT's Ethernet protocol stack includes all features of the current ETHERNET Powerlink specification and allows for the implementation of Managing 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 ETHERNET Powerlink in environments with or without an operating system.

Embedded module

IXXAT's EPL module provides all ETHERNET Powerlink functions for a Controlled Node, which makes this PCB a very flexible solution to EPL-enable various devices such as drives, I/O modules or encoders. The core component of the embedded module is an Altera FPGA consisting of 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 ETHERNET 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 the EPL-API available on the PC.

EPLsafety

IXXAT's EPLsafety software was developed in-house. It 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

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

Further information about our products is available at

www.ixxat.de

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Masthead

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One Step Ahead!

While others are still working on their real-time Ethernet concepts, ETHERNET Powerlink users are working with readily available systems. More than 150,000 installed nodes and 5 years of serial production, with product support from global leading automation vendors, makes ETHERNET Powerlink the most mature and most reliable real-time Ethernet solution on today's market.

ETHERNET Powerlink – The decisive step ahead.

Why are you waiting?
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www.ethernet-powerlink.org

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