Pushing Industrial Communication Limits:
Intel® Ethernet Controller I210 meets PROFINET

KW-Software opens up new possibilities for PROFINET industrial communication and networking solutions, with enhanced data throughput and synchronization powered by the Intel® Ethernet Controller I210.

PROFINET is a worldwide standard for Ethernet-based industrial communication. Control and device manufacturers need fast, scalable, and cost-effective integration possibilities for leading-edge PROFINET communication solutions. KW-Software helps meet that challenge with communication components that are early to market in stable forms for new Intel® processors and a variety of real-time OSs, including Wind River VxWorks®, Microsoft Windows®, and many others.

KW-Software’s technologies are designed so that customers can tailor them to individual requirements for unique products and solutions. Customers can choose individual components or a complete solution, to efficiently implement their expertise and differentiating features. Collaborative work with Intel helps KW-Software pass the benefits of cutting-edge processors and Ethernet controllers on to its customers.

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**SOLUTION BRIEF**

**Intel® Ethernet Controller I210**

**KW-Software**

**TECHNOLOGY FOR AUTOMATION LEADERS**

KW-Software has been developing software technologies for more than 30 years. The company’s core offerings include standards-based software components for industrial control (IEC 61131), safety technology (IEC 61508), and PROFINET communication and networking. Collaboration with Intel enables further innovation at KW-Software, which helps keep the company and its customers a step ahead of the competition. KW-Software is a PHOENIX CONTACT company.

**PROFINET Industrial Communication Standard**

Industrial control systems require increasing levels of synchronization and accuracy. This performance is achieved with specialized IO protocols specifically designed with these goals in mind. The popular PROFINET industrial protocol delivers high precision and performance using Ethernet as its communication medium. However, components using the synchronous PROFINET IRT communication have to date been based on high-cost ASICs or FPGAs.
The combination of the Intel® Ethernet Controller I210, Intel processors, and KW-Software’s PROFINET stacks delivers the high accuracy and low jitter required by demanding industrial control applications, along with all the benefits of standard PC components, including low cost and simplicity of programming.

PROFINET’s modular range of functions enhances its flexibility across applications and markets. With PROFINET, applications can be implemented for production and process automation, safety applications, and the entire range of data-exchange demands, including the extreme precision in bus cycles and low jitter required for isochronous real-time (IRT) implementations such as positioning control processes. Application profiles allow optimal use of PROFINET across various areas of automation engineering.

Engineered to be fully compatible with IEEE-standard Ethernet, PROFINET adapts to circumstances in the existing plant thanks to its flexible line, ring, and star structures that are compatible with both copper and fiber-optic cabling, helping to avoid the expense of custom solutions. PROFINET also enables wireless communication with WLAN and Bluetooth® technology.

Various types of real-time communication with different requirements coexist within PROFINET solutions; these can range from simple control tasks to highly demanding motion-control and safety applications. PROFINET IO is capable of passing all of these traffic flows over a single cable or wireless connection, enabling substantial efficiencies in terms of devices, engineering, and setup.

To differentiate and prioritize among these different traffic types, the scope of functions supported by PROFINET IO is divided into conformance classes. The three conformance classes build upon one another and are oriented to typical applications, as illustrated in Figure 1.

- **Conformance Class A (CC-A)** provides basic functions for PROFINET IO with real-time communication. All IT services can be used without restriction. Typical applications are found, for example, in building automation. Wireless communication is possible only in this class.

- **Conformance Class B (CC-B)** builds on CC-A by adding network diagnostics and topology information. The system redundancy function important for process automation is contained in an extended version of CC-B called “CC-B (PA).”

- **Conformance Class C (CC-C)** relates to very time-critical processes that may require a jitter of less than 1 microsecond in line topologies (i.e., IRT communication). Cyclic data packets are transferred using reserved bandwidth, and all other packets, such as those for diagnostics or TCP/IP, share the rest of the Ethernet bandwidth.

### Intel® Ethernet Controller I210

The Intel Ethernet Controller I210 enables groundbreaking performance of real-time protocols such as PROFINET IRT with a standard Ethernet controller. Eliminating the need for a custom solution translates into a number of advantages for the end user, including the ability to achieve high-precision, low-jitter performance at a much lower price point and with low space and power requirements. This allows industrial control systems to take advantage of the ever-increasing performance of Intel processors with the high precision IO that IRT communication requires.

Similar to the PROFINET protocol itself, a key advancement that makes the Intel Ethernet Controller I210 unique among standard Ethernet controllers is the separation of real-time and non-real-time communication. The Intel Ethernet Controller I210 implements separate in-chip queues for handling real-time communication. Communication from these queues is managed in relation to a high-precision clock, enabling real-time communication to occur with precise timing, as specified by the PROFINET protocol. When this capability is paired with KW-Software’s PROFINET IRT protocol software stack, users can achieve previously unheard-of levels of precision with a standard Ethernet controller, while also concurrently supporting standard IT communication and remote manageability.

The standards-based Intel Ethernet Controller I210 has many key advantages compared to custom FPGA- or ASIC-based implementations:

- Lower cost
- Superior energy efficiency
- Smaller footprint, compatible with the Intel® 82574L Gigabit Ethernet Controller
- Integrated triple-speed BASE-T PHY
- SerDes/SGMII interfaces available
- Industrial temperature support available
- Production availability for seven or more years

### KW-Software’s PROFINET Solution

KW-Software’s PROFINET stacks, illustrated in Figure 2, have been used successfully for years in sophisticated automation projects in a great variety of different sectors, including the automotive industry, machine building, and process automation. Because no specific hardware support is required for PROFINET real-time communication (conformance classes A and B), the stacks are used on most diverse hardware platforms with standard Ethernet interfaces, ranging from PCs to complex robotic controls.

"Formerly, special hardware was needed, including expensive, custom-built ASICs, FPGAs, or extension boards. Now, with the Intel® Ethernet Controller I210, we can provide PROFINET IRT communication at far lower cost."

— Peter Fuchs, Head of Marketing Communications, KW-Software
The PROFINET stacks offer a broad range of features and capabilities across many processor architectures and real-time OSs.

- **Versions for different PROFINET device classes.** The stacks are available as versions for PROFINET devices or PROFINET controllers. A combined PROFINET controller and device stack allows quick and direct communication among several PROFINET controllers. Typical application examples include redundant or hierarchically segmented automation networks, which are commonly used in large networked production plants.

- **Fast and simple integration with applications.** The PROFINET stacks are available as compiled and linked object libraries for specific combinations of processors, OSs, and compilers. For Windows, a DLL is available as well. Users can thus save valuable time during integration and certification of PROFINET interfaces.

- **Configuration tool for PROFINET networks.** PROFINET Configurator provides a clear graphical user interface for configuring PROFINET networks, as shown in Figure 3. The tool is designed for standalone or integrated use. It creates an XML-based file from the network configuration, which is further processed directly by the PROFINET controller stack. Kw-Software also provides open interfaces for individual engineering solutions.
Conclusion
The combination of the Intel Ethernet Controller I210 and KW-Software PROFINET stack enables unprecedented cost-effectiveness for industrial-automation software solutions, while also taking advantage of advances in areas such as performance and efficiency that are built into the latest Intel processors. This approach is capable of supporting even highly demanding usage models in industrial control, such as motion sensing and positioning.

The already broad support for multiple real-time OSs and various types of hardware is growing constantly, affording customers a robust set of options in automation technology.

“KW-Software will make the PROFINET stacks for the Intel® Ethernet Controller I210 available for various processor architectures and real-time operating systems, such as Wind River VxWorks.”

– Peter Fuchs, Head of Marketing Communications, KW-Software

For more about KW-Software, see www.kw-software.com
For more about Intel® Ethernet, see www.intel.com/go/ethernet