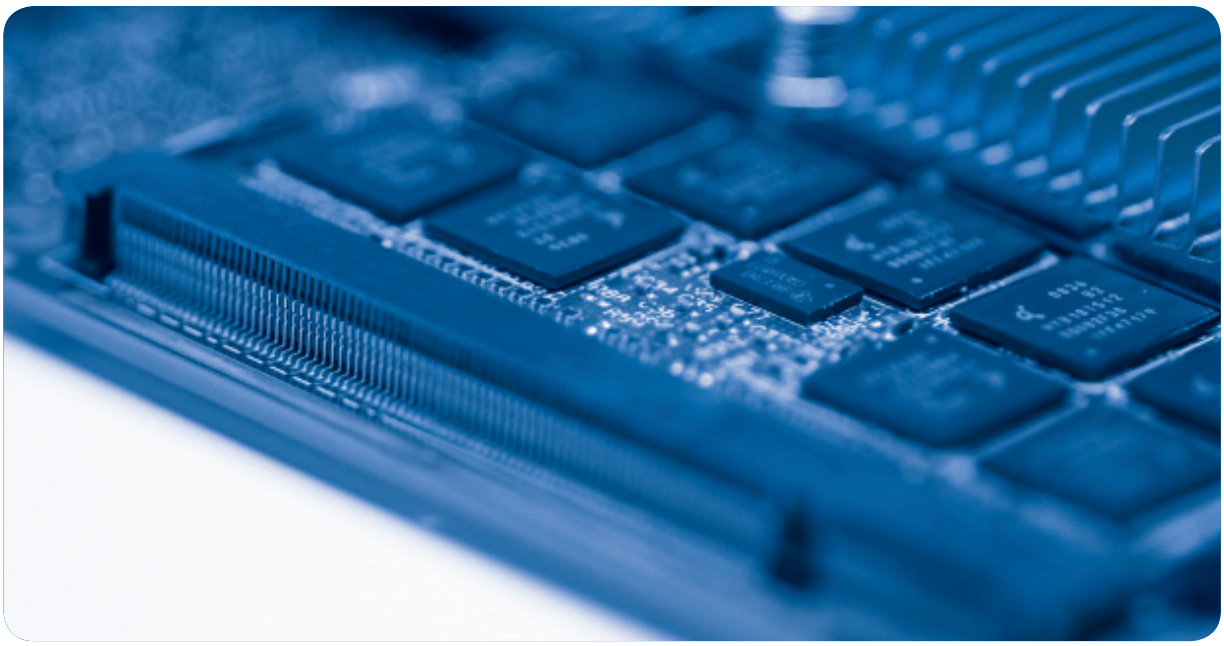
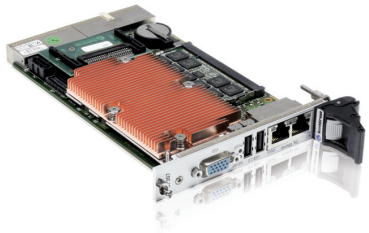
» Application Story «

CompactPCI® in Industrial Automation



Custom boards for universal use

Customized Kontron CompactPCI® CPU boards provide costoptimized and rugged performance for industrial image processing



Sophisticated image processing systems are becoming an increasingly indispensible part of quality control on automated filling and packaging lines that require zero failure tolerance. The embedded computer technology used in the systems needs to offer price-optimized, highly reliable real-time performance in a rugged environment. To meet these demands, one of the world's leading designers and suppliers of filling lines and control systems has developed a highly flexible image processing system based on custom-designed 3U CompactPCI® CPU boards from Kontron.

Based in Neutraubling, Germany, Krones is the world's market leader in supplying systems and complete processing lines for filling and packaging. The company designs, develops, produces and installs customized filling lines for beverage manufactures and the food packaging industry as well as the chemical, pharmaceutical and cosmetic industry. An

Figure 1: Reliable performance. The image processing system based on Kontron custom CP306 CompactPCI® CPU boards is ideally suited for zero-failure tolerance filling lines with rugged, harsh environments.

increasingly indispensable part of modern processing lines is the image processing technology that is used for quality control at various stages of the production and filling process, e.g. after washing to check the quality of the outside and inside of containers, after filling to check the filling level and the seal, and after labelling to check the position of each label and the best before date. Depending on the number of stages required, a typical filling line could have as many as 20 different camera systems each running different software applications.

One cost-effective system for all applications

With a large number of camera systems running various applications in different industries, the challenge for Krones was to develop a cost-effective system that is easy to integrate, install and maintain regardless of the application area. Reliability is also critical – the systems need to operate 24 hours a day, 7 days a week under tough operating conditions with strong vibrations emanating from the conveyors and other plant machinery. To meet these demands, Krones developed a universally applicable system with a central server and distributed image processing units based on custom-designed CP306 CompactPCI® CPU boards from Kontron. The CompactPCI® boards provide exactly the right cost-effective performance and high availability combined with long-term availability.

Inherently rugged design

CompactPCI® is a natural choice for the harsh operating conditions found on the high-speed processing lines in various industries. The robust connectors, metal guides and metal front plate hold the CPU boards firmly in place inside the camera system's mounting case. The fanless design with a heatsink directly screwed to the board as well as directly soldered CPU and memory provide a board design that is inherently resistant against vibrations and shocks. Moreover, the CompactPCI® connector offers optimal protection against the damp conditions and, in some cases, aggressive airborne agents found in filling plants.

"Blank slate" concept for flexible, cost-effective system design

To keep production and maintenance costs to a minimum,Krones devised a novel "blank slate" concept that enables image processing units with the same hardware configuration to be deployed on a wide range of different applications. The Krones inspection and control system consists of a central server connected via Fast Ethernet to a number of distributed image processing systems located at various stages of the production line. Each image processingsystem consists of up to four digital cameras (depending on the application), the corresponding number of frame grabber cards and a customized Kontron CP306 CompactPCI® CPU board. After preprocessing the information from the cameras, the frame grabbers transmit the uncompressed image data, which could be a simple black & white bit map, a grey scale image or an RGB image depending upon the application, to the Kontron CP306 via the board's CPCI connectors. Image processing software written by Krones runs on the CP306 under Linux OS and determines, for example, whether a container is clean or contaminated or whether the fill level is within specified limits, depending on the designated task. The result (good or defect) is transmitted back to the frame grabber and forwarded via Ethernet to the central server which is responsible for high level control of the processing line. The Kontron CP306 boards boot via Ethernet from the central server from which they also receive the application software and parameters for the required image processing task. This system concept makes the Krones inspection and control system extremely flexible and cost-effective. The individual image processing systems are like blank slates, ready to perform whichever image processing task is required. They are therefore application independent and can be used for a wide range of different inspection tasks at various stages of the production line. This brings a number of important time and cost benefits. An image processing system used for reading labels, for example, can be quickly and cost-effectively dismounted and integrated into an earlier processing stage where it might perform a completely different image processing task. Moreover, the blank slate concept simplifies configuration of the image processing systems since there is no need to configure the systems for individual applications. Krones

simply assembles the systems with the appropriate number of cameras and frame grabbers and a Kontron CP306 CPU board. This enables Krones to efficiently manufacture batches of systems every year with minimal integration costs regardless of whether they are used for measurement, surface inspection, texture inspection, code reading, text reading, print and inscription control or behaviour analysis. It also ensures that replacement systems are always on hand in the event of a fault because there is no need to supply an application-specific replacement.

Figure 2: The 'blank slate' principle provides exceptional application flexibility and easy integration. This picture shows a high end system with a total of 8 camera systems on two levels.

Cost-optimized custom design

Another critical cost-saving factor was Kontron's ability to supply a custom version of the CP306 CPU board. For the Krones solution Kontron's team of hardware engineers annually supply a large batch of custom boards reduced to only the application necessary components.Since the CP306 boots from the central server, there is no need for a battery, clock buffer, Compact Flash or hard drive. Unneeded interfaces have also been omitted – each system includes a specially adapted Kontron CP306 CPCI board containing only one Ethernet port for communication with the central server and 4x CompactPCI® slots for the frame grabber cards. Kontron's software engineers also developed and supplied a customized BIOS for Etherboot 3.6 compatibility. The result is a slimmed down and cost-optimized custom design for universal application in the Krones system configuration. "Finding a vendor that also offers the engineering support to supply cost-optimized CPU boards that are reduced to the max and contain only the components we need was extremely important", explains Andreas Bergers, purchasing manager at Krones. "The custom Kontron CP306 board not only offers the right price-performance ratio, it also enables us to offer our customers a rugged, reliable and, above all, price-sensitive solution."

Real-time performance

Stable real-time operation is also crucial. Image processing needs to keep pace with the speed of production. Any containers that are not completely processed by all of the graphic inspection systems are treated as defect and removed from the production line, resulting in higher costs. The Kontron CP306 receives uncompressed image frames from the frame grabber cards. The picture repetition rate is usually between 20 and 40 Hz but can reach 100 Hz in certain applications. Running at 100 Hz with 1 digital picture per container, the Kontron CP306 boards are capable of handling an impressive throughput of up to 360,000 containers per hour. This level is never reached in actual processing lines. All the applications running at 100 Hz require more than one digital picture per container and the average throughput lies between 60,000 and 120,000 containers. The CP306 easily handles the average data transfer rate on the PCI bus of 60 MB/s. Peak load is 80 MB/s. The necessary processing performance for the Kontron CP306 boards is provided by either the 1.5 GHz Intel® Celeron® M processor or 1.8 GHz Intel® Pentium® M processor depending on the intended applications. (For applications requiring greater processing performance Kontron 3U CPCI boards are also available with the latest Intel® dual-core processors - see sidebar). Using two different performance versions optimizes the priceperformance ratio of the systems while maintaining the high degree of standardization required for easy integration and deployment flexibility. The result is an extremely flexible, robust, low maintenance and high-performance system that is running smoothly in numerous filling lines all over the world.

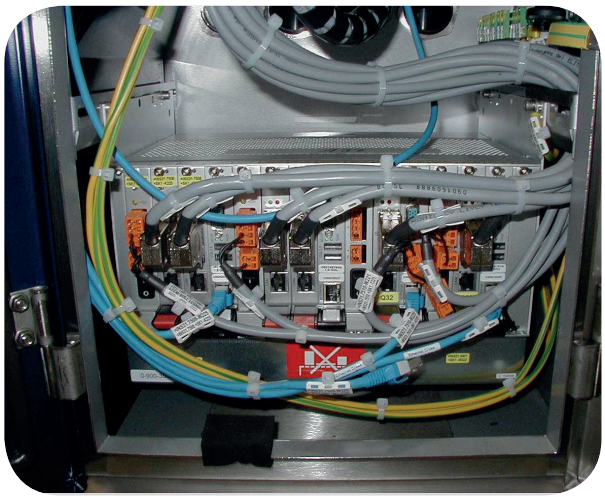


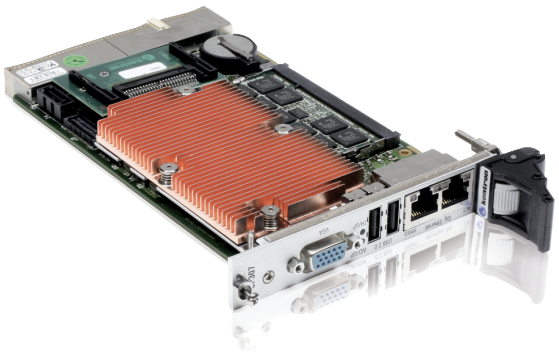
Figure 3: A Krones image processing system with four Kontron CP306 boards connected to multiple frame grabber cards.

Kontron custom design services

For fastest time-to-market and reduced cost of ownership, more and more OEMs are turning to vendors who can supply not only a wide range of standard boards but, more importantly, additional custom design and manufacturing services. Kontron already offers the latest processor technology on a range of well-established and proven embedded platforms on various form factors and has the widest form factor portfolio in the embedded computing industry. Moreover, the company is one of the world's leading vendors with the stability to ensure the long term availability of all form factors. In addition to providing high quality embedded computing technology, Kontron also offers the full range of value-adding design services, from custom design boards and embedded platforms to complete systems in customized housings, and has its own manufacturing facilities in Malaysia for high volume production. With almost 900 highly qualified hardware and software engineers around the world, Kontron has one of the largest engineering head counts in the embedded industry for developing standard and custom boards, systems and software engineering. This makes Kontron not only a vendor of boards and platforms for solution providers, but also a design and manufacturing partner for customized designs based on embedded computer technology that helps OEMs differentiate their solutions and be first to market in the industrial, transportation, medical, infotainment, energy, communication and defence/ aerospace sectors. The custom board for Krones demonstrates the cost-saving benefits of using custom-design services for mid- to high volume projects.

Kontron CP307-64: 3U CompactPCI® CPU board with high-end 64-bit performance

In addition to the Kontron CP306 CompactPCI® board that offers rugged and cost-effective Intel® Pentium® M processor performance, applications requiring greater processing power will benefit from the Kontron CP307 and CP307-64 that bring dual core performance to 3U CompactPCI® CPU boards. The CP307-64 is the most powerful version with Intel CoreTM 2 Duo processors. Integrated with the Intel® Mobile 945GM Express chipset and ICH7-R Southbridge, the Kontron CP307-64 achieves unprecedented performance-per-watt values in a 3U form factor. It has an extensive set of on-board features, including – options for 1.5 GHz low-voltage (L7400) or 2.16 GHz (T7400) processors; 667 MHz front side bus; a DDR2-SDRAM main storage with a 667 MHz storage sequence that is expandable up to 4 GBytes; 10.6 GBits data throughput; and extensive communications interfaces. Moreover, there are 2x GBit Ethernet connectors, up to 6x USB 2.0, a maximum of 4x SATA-300 interfaces, and an available CompactFlash socket. To complete the CPU architecture, PCI-Express is used as the data bus to the Ethernet channels for high network bandwidths. The graphics accelerator integrated into the Mobile Intel® 945GM Express ensures excellent 2-D, 3-D and video features for VGA and DVI, which are available in dual operation. The Kontron CP307-64 is offered in single slot (4HP) and dual slot (8HP) options, with the latter providing additional legacy support, namely LPC, COM, DVI and 2.5" SATA. Rear I/O-variants of the Kontron CP307-64 with suitable rear modules allow service-friendly system structures in which the wiring and interface connections are shifted to the rear panel of the system. The Kontron CP307-64 is an ideal fit for a broad range of compute-intensive embedded applications. With a soldered processor and up to 2 GBytes soldered storage, the Kontron CP307-64 can be used under the harshest environmental conditions, such as assembly lines, aircraft, rail and maritime applications, as well as mobile test benches and measuring devices. With such exceptional CPU performance in a small form factor, the Kontron CP307-64 is equally suitable for the highperformance requirements of image processing and data collection systems.



About Kontron

Kontron is a global leader in embedded computing technology. With more than 40% of its employees in research and development, Kontron creates many of the standards that drive the world's embedded computing platforms. Kontron's product longevity, local engineering and support, and value-added services, helps create a sustainable and viable embedded solution for OEMs and system integrators.

Kontron works closely with its customers on their embedded application-ready platforms and custom solutions, enabling them to focus on their core competencies. The result is an accelerated time-to-market, reduced total-cost-of-ownership and an improved overall application with leading-edge, highly-reliable embedded technology.

Kontron is listed on the German TecDAX stock exchanges under the symbol "KBC". For more information, please visit: **www.kontron.com**

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