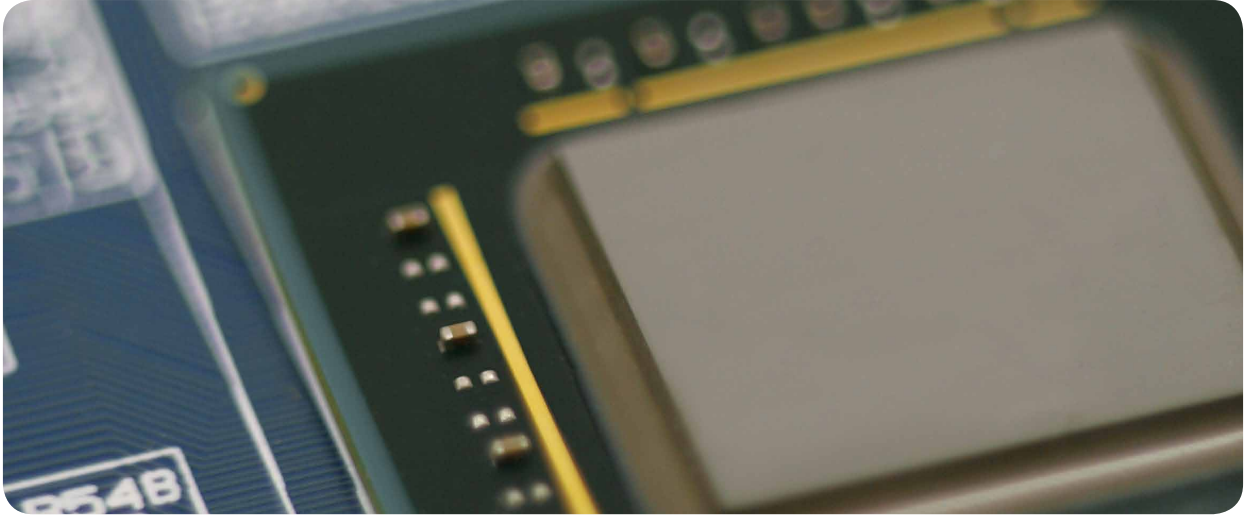


# » Application Story «

COM in Medical



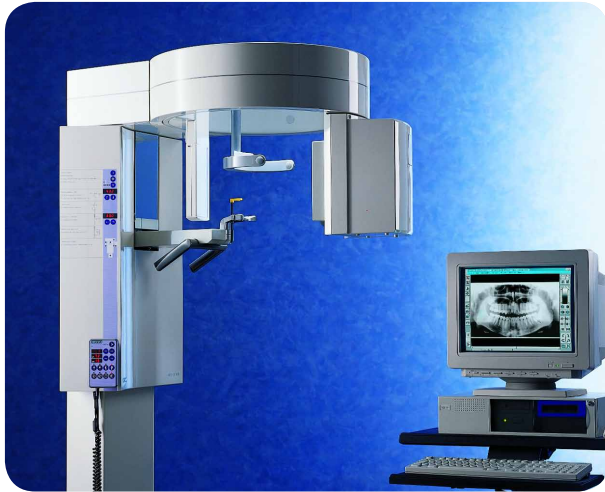
## Kontron CPU Board Controls Sirona's Dental X-Ray Machines

**Embedded Systems for Digital Medical Technology**



A custom CPU card from Kontron Modular Computers GmbH of Kaufbeuren, Germany controls the analog and digital X-ray systems made by Sirona Dental Systems GmbH. With an 80 MHz Freescale MPC855T, the board functions as the central intelligence for the dental equipment company's high-end systems. Kontron combines development expertise for the CPU modules with low cost, excellent support, and ample production capacity for the high volumes needed.

Digital photography has already largely replaced film-based photography; only die-hard photography enthusiasts still cling to the visual charm of analog paper photos. A very similar change is occurring in modern X-ray diagnostics: conventional machines are going the way of analog small-



format cameras; they are just disappearing a bit more slowly. This change is being driven by the tremendous advantages offered by digital X-ray technology for medical applications: it increases the diagnostic options and processes in dental surgeries and hospitals, and does less harm to patients and the environment because a lower radiation dose and no photographic chemicals are needed. Since there is no need to develop film, digital X-rays are available within seconds throughout a network: in treatment rooms, in the operating room, and on treatment units. They can be edited and linked to additional information – e.g., the recording parameters – to enable better recognition of findings or illustration of necessary treatment. If there are faults in the exposure, the computer can remove them. Archiving and administration of electronic images is considerably easier than storage of conventional X-rays.

## Digital and Analog Dental X-Raying

Sirona Dental Systems GmbH of Bensheim, Germany is bringing digital X-raying to dental and orthodontic offices. The digital machines, and their analog counterparts, are on the market under the product name "ORTHOPHOS." Sirona ensures an easy and safe transition from traditional to modern X-ray diagnostics by making it possible for dentists to upgrade analog versions to make them digital. The ORTHOPHOS XGPlus, the top of the Sirona's range of digital remote and panorama X-ray machines, unites a myriad of diagnostic possibilities and reduced radiation exposure with simple operation and perfect adaptation to an office workflow.

With panorama X-raying, the entire jaw is photographed in one recording. In order to display the jaw as a whole, the X-ray emitter moves in a defined curve around the patient's stationary head at jaw level and projects the image either in analog format onto a light-sensitive X-ray film or onto sensors that forward the digitized image data for processing. Remote X-ray recordings capture an image of the entire skull. With analog recording, images are recorded in one step using a pyramid-shaped X-ray beam; with digital recording, a fan-shaped, flat beam that probes the skull in narrow layers. Sirona's ORTHOPHOS machines are available as pure panorama X-ray machines and as combination systems for both perspectives.

## CPU Card From Kontron Controls ORTHOPHOS

The central intelligence of all four types of machine is a processor card from Kontron Modular Computers GmbH of Kaufbeuren, Germany. It controls the path of the recording ring, ensures that exact exposure times are used, doses the X-ray radiation, and, in the case of digital systems, processes the image data. The DX11 CPU card for the ORTHOPHOS machines is equipped with an 80 MHz Freescale MPC855T, 32 MB of Flash, and 128 MB of SDRAM. In addition, it has a real-time clock and a Flash Bootloader. There are no SDRAM memory strips/plug-in strips because there is no need for them. The robust Freescale CPU, which offers long-term availability, is aimed at price-sensitive applications with large amounts of data. Apart from the core, a dedicated communication processor ensures rapid data throughput. The first tests showed that the processor could easily process the enormous flood of data (several hundred megabytes) that is accumulated within half a second during a jaw scan. It is so inexpensive that it also pays to use it in conventional X-ray machines and hence enable a conventional-to-digital conversion.

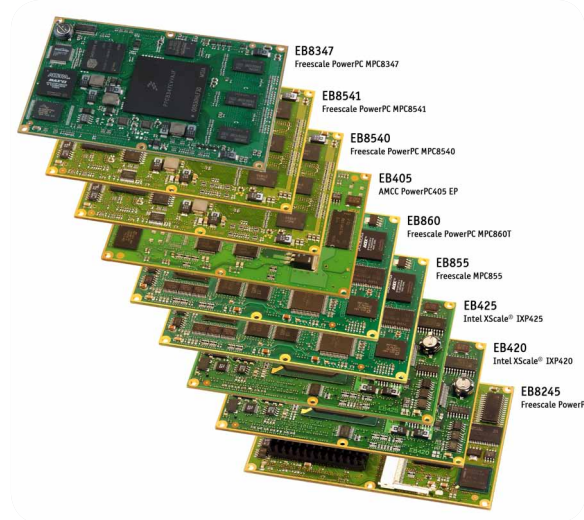


## Development Partnership: Core Competences Join Forces

The DX11 is the perfect example of a partnership between Kontron, as the CPU development expert, and industry-oriented technology companies.

Sirona's expertise in dental equipment is recognized throughout the world. For this product, Sirona concentrated on the machine elements requiring industry-specific knowledge such as the X-ray recording equipment and relied on expert partners to do the needed development work outside of its own core competence areas. For the CPU unit, Sirona looked for a provider with proven skills in the development of customized processor boards and the ability to develop and produce at low cost. Partner companies needed to be large enough to guarantee delivery for the high product volumes required and to have an international presence in order to provide excellent worldwide technical support.

The choice of the "CPU partner" was particularly important: the CPU card, as the central intelligence for the ORTHOPHOS systems, bears a large part of the responsibility for ensuring that Sirona's products deliver needle-sharp images, paths with computer precision, and constant X-ray beams. Kontron ultimately got the chance to develop the DX11 because as the market leader in embedded systems, it scored highly in all categories and most closely matched Sirona's ideal for a technology partner.



### Excursus: From Individual Development to Computer-on-Module

The partners' contributions to the intelligence of the ORTHOPHOS machines are reflected in the design of the controller: The DX11 is mounted as a CPU card on

a baseboard that Sirona developed. The application-independent functions are situated on the Kontron product, and the baseboard carries the X-ray machine-specific elements. The respective areas of expertise are semi-encapsulated and coupled via clean interfaces, so the complexity of the cooperation is reduced to a minimum. Kontron has turned this type of cooperation into a standard, from which the Computer-on-Module concept arose (Computer-on-Module = COM).

Because the requirements on CPU cards are tend to be comparable and largely application-neutral, Kontron developed a whole series of standard boards as COMs, all with the same interfaces and mounting holes. Industry-oriented technology firms can purchase these COMs as standard products and mount them onto baseboards they develop themselves without having to worry about CPU design-in. The uniform interfaces and mounting holes guarantee that over the course of the product life cycle, the processor performance or the processor type can always be changed with no need to touch the baseboard. From the DX11 and similar developments arose the E2Brain series for COMs with RISC processors. Kontron has now published the design guidelines for E2Brain modules, thereby creating the first COM standard for RISC systems.

### Cooperation with a Future

The cooperation between Sirona and Kontron has proven itself to be successful: while 2,000 DX11 cards are being produced, partners are already working on the next generation, the DX11/2. It was originally intended that Sirona would assume production itself in the second generation but because the cooperation is functioning so well, Kontron will also produce the next ca. 6,000 boards. There are plenty of reasons to extend this cooperation: Sirona, as a complete provider of dental equipment, is working on a completely networked and digitized dental office. Apart from X-ray machines, there are also dental units, CAD/CAM systems for computer-assisted production of dental prostheses, instruments, and hygiene equipment.



### The Freescale MPC855T in Detail

The MPC855T is a versatile microprocessor-peripheral combination on a chip. It is designed for low-cost equipment with Fast Ethernet support. This member of the MPC860 PowerQUICC family combines an MPC8xx-core processor with a Freescale communication processor designed as a separate RISC machine and relieves the MPC8xx core of communication tasks.

The MPC855T distinguishes itself from other products in the PowerQUICC family by the fact that it has only one

serial communication controller instead of four. It is produced with Freescale's 0.32-micron technology, which enables operation with 3.3 volts and a 3.3-volt I/O voltage.

The MPC855T sits on a 357-pin BGA socket and is footprint-compatible with the existing MPC860 PowerQUICC designs. It is available with a clock speed of 50, 66, or 80 MHz.

### Features of the MPC855T

Embedded MPC8xx core with 105 MIPS at 80 MHz (Dhrystone 2.1)

- » 4-KB instruction cache
- » 4-KB data cache
- » 8 KB of dual-port RAM
- » Instruction and data MMUs
- » Up to 32-bit data bus (dynamic bus sizing for 8, 16, and 32 bits)
- » 32 address lines
- » Complete static design (0-80 MHz operation)
- » Memory controller (8 banks)
- » General-purpose timers
- » System integration unit (SIU)
- » Interrupts
- » Communications processor module (CPM)
- » 4 baud rate generators
- » 1 SCC (serial communication controller)
- » 2 SMCs (serial management channels)
- » 1 SPI (serial peripheral interface)
- » 1 I2C (inter-integrated circuit) port
- » Time slot assigner
- » Parallel interface port
- » PCMCIA interface
- » Low-power support
- » Debug interface
- » 3.3-V working voltage and 3.3-V I/O voltage

### About Sirona

Sirona is one of the world's leading manufacturers of dental equipment. The company produces dental units, imaging systems, instruments, and hygiene equipment as well as systems for computer-supported ceramic restoration (dental CAD/CAM systems). The products are marketed in over 100 countries throughout the world. With headquarters in Bensheim, Germany, the company has subsidiaries and representatives in 16 countries. For more than 125 years Sirona has stood for innovation leadership in the dental industry; today the company has 1,700 employees. In the fiscal year 2004-2005, the company achieved sales of 365 million euros (ca. US\$467.2 million) and an EBITDA including special items of 84 million euros (ca. US\$107.5 million).

## About Kontron

Kontron designs and manufactures standards-based and custom embedded and communications solutions for OEMs, systems integrators, and application providers in a variety of markets. Kontron engineering and manufacturing facilities, located throughout Europe, Americas, and Asia-Pacific, work together with streamlined global sales and support services to help customers reduce their time-to-market and gain a competitive advantage. Kontron's diverse product portfolio includes: boards and mezzanines, Computer-on-Modules, HMIs and displays, systems, and custom capabilities.

Kontron is a Premier member of the Intel® Embedded and Communications Alliance.

For half-a-decade now, Kontron has been named a VDC *Platinum Embedded Board Vendor*. Based entirely on user feedback, industry professionals evaluate vendors on over 45 non-product related criteria. Kontron is only one of two companies to receive the Platinum award 5-years running.

Kontron is listed on the German TecDAX stock exchange under the symbol „KBC“.

For more information, please visit: [www.kontron.com](http://www.kontron.com)

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